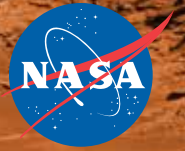


National Aeronautics and  
Space Administration



# Kennedy Space Center Annual Report FY2015





# Table of Contents

Vision, Mission & Core Competencies .....	2
Center Director's Message .....	3
Significant Events.....	4
Center Planning & Development.....	12
Commercial Crew Program.....	14
Launch Services Program.....	22
Ground Systems Development & Operations Program .....	24
Exploration Research & Technology.....	30
Engineering .....	36
Spaceport Integration .....	38
Education.....	42
Communication & Public Engagement .....	46
Kennedy Business Report.....	50
CFO Report	
Workforce Overview	
Procurement Report	





# Vision, Mission & Core Competencies

## KSC Vision

KSC is the world's preeminent launch complex for government and commercial space access, enabling the world to explore and work in space.

## KSC Mission

KSC safely manages, develops, integrates and sustains space systems through partnerships that enable innovative, diverse access to space and inspires the nation's future explorers.

## KSC Core Competencies

- Acquisition and management of launch services and commercial crew development
- Launch vehicle and spacecraft processing, launching, landing and recovery, operations and sustaining
- Payload and flight science experiment processing, integration and testing
- Designing, developing, operating, and sustaining flight and ground systems, and supporting infrastructure
- Development, test and demonstration of advanced flight systems and transformational technologies to advance exploration and space systems

# Center Director's Message

This past fiscal year (FY) has been an important one for NASA's Kennedy Space Center. The vision of transitioning from a government-only launch facility to an affordable and flexible multi-user spaceport is now reality. All across the spaceport there are tangible signs of progress ensuring Kennedy will remain the world's preeminent launch complex for government and commercial access to space for decades to come.

At the beginning of FY 2015, our nation took a giant step toward the exploration of deep space with the successful launch, splashdown and recovery of the Orion spacecraft during Exploration Flight Test-1. Now, little more than a year later, the historic Vehicle Assembly Building is being reconfigured with new work platforms to support processing of the Space Launch System (SLS) and Orion spacecraft, which will carry astronauts to new destinations in our solar system.

Orion's next flight, Exploration Mission-1 slated for 2018, will lift off from Kennedy atop the powerful SLS, making it the first fully integrated flight test for NASA's future deep space expeditions. The amazing work the Ground Systems Development and Operations Program conducted during FY 2015 will make that flight possible—from rebuilding the flame trench, refurbishing propellant lines and modernizing the infrastructure at Launch Pad 39B to overhauling the iconic crawler-transporter to carry the largest rocket ever constructed.

As we look to explore beyond low-Earth orbit, NASA's Commercial Crew Program is working with our commercial partners, Boeing and SpaceX, to restore our capability to launch astronauts to the International Space Station from American soil. FY 2015 started one month after awarding the landmark contracts and throughout the year both providers made monumental strides developing and testing their systems. This past July, NASA announced four astronauts who will work with both companies and will train to fly aboard Boeing's CST-100 Starliner and SpaceX's Crew Dragon.

In FY 2015, nine years after the New Horizons spacecraft

launched from Cape Canaveral through the Launch Services Program (LSP), the world got its first up-close look at Pluto—the dynamic dwarf planet near the edge of our solar system. The Juno spacecraft that launched in 2010 will arrive at Jupiter this July to provide unprecedented insight about the gas giant. A little closer to home, LSP awarded three

Venture Class Launch Services contracts for a new category of rockets that will carry cubesats to low-Earth orbit. Though small in size, cubesats provide a huge return in scientific knowledge.

Kennedy's Center Planning and Development Directorate, the "front door" for the spaceport, helped transition the Shuttle Landing Facility to Space Florida during the summer of 2015. Because of our dynamic master plan and new way of doing business, Kennedy is poised for continued growth and successful partnership development in the future.

For more than 50 years, Florida's Space Coast has been the only place in our nation to launch humans to orbit. Remarkably, with Blue Origin's recent announcement, Kennedy is now home to four human spaceflight programs planning to launch crews in the near future.

NASA is committed to the journey to Mars, to learning more about our home planet, and to improving life on Earth through research and technology. Kennedy's contributions are vital to accomplishing those goals. I invite you to read more about them in the following pages.



**Robert D. Cabana**  
Center Director



# Significant Events

1	<b>Oct. 7, 2014: Central Campus Groundbreaking</b> Groundbreaking for the new Central Campus took place in the Industrial Area at Kennedy Space Center. Central Campus Phase I includes construction of a new seven-story, 200,000-square-foot Headquarters Building.	
2	<b>Oct. 15, 2014: Spacewalkers Prep Station for Commercial Crew Craft</b> Astronauts Reid Wiseman and Barry “Butch” Wilmore conducted spacewalks to prepare the International Space Station for the arrival of Commercial Crew Program partner spacecraft later this decade.	
3	<b>Oct. 17, 2014: Boeing Concludes Commercial Crew Space Act Agreement for CST-100/Atlas V</b> Boeing completed the final milestone of its CCiCap Space Act Agreement with NASA. The work and testing completed under the agreement resulted in significant maturation of Boeing’s crew transportation system, including the CST-100 Starliner spacecraft and Atlas V rocket, as well as ground and mission operations.	
4	<b>Oct. 23, 2014: Iconic Mate-Demate Device Demolished</b> With only the steel structure remaining, crews prepared to demolish the 150-foot-long, 93-foot-wide and 105-foot-high Mate-Demate Device (MDD) at the center’s Shuttle Landing Facility. The MDD stood for more than 35 years as a key facility supporting the Space Shuttle Program and was demolished to make way for current and future space program needs.	
5	<b>Nov. 11, 2014: Orion Rolls to Launch Pad for Exploration Flight Test-1</b> The Orion spacecraft rolled to Launch Pad 37 at Cape Canaveral Air Force Station in Florida, to be hoisted atop a United Space Alliance Delta IV Heavy rocket for the uncrewed Exploration Flight Test-1.	
6	<b>Dec. 5, 2014: Orion Launches on Exploration Flight Test-1</b> The Orion spacecraft launched atop a United Launch Alliance Delta IV Heavy rocket from Space Launch Complex 37 at Cape Canaveral Air Force Station in Florida at 7:05 a.m. EST. During the two-orbit, 4.5-hour flight test, Orion reached an altitude of 3,604 miles above Earth. The spacecraft splashed down in the Pacific Ocean at 11:29 a.m. EST. Recovery team members with the Ground Systems Development and Operations Program, the U.S. Navy and Lockheed Martin secured the spacecraft in the well deck of the USS Anchorage.	
7	<b>Dec. 17, 2014: Crane Modifications Begin in the Vehicle Assembly Building</b> Inside the Vehicle Assembly Building, the 175-ton crane was lowered to the transfer aisle floor. Work began to refurbish the crane and upgrade its 45-year-old controls to improve reliability, precision and safety to support lifting needs for NASA’s Space Launch System rocket and Orion spacecraft.	

8	<b>Dec. 19, 2014: Kennedy Workforce Views Flown Orion Spacecraft</b> The NASA and contractor workforce viewed the Exploration Flight Test-1 Orion spacecraft in the Launch Abort System Facility at Kennedy Space Center. After recovery, Orion made the 2,700 mile road trip from Naval Base San Diego in California back to the center.	
9	<b>December 2014: Boeing Completes First Crew Transportation Contract Milestone</b> NASA approved the completion of Boeing’s first milestone, the Certification Baseline Review, in the company’s path toward launching crews to the International Space Station from the U.S. under a groundbreaking CCiCap contract.	
10	<b>December 2014: SNC Tests Dream Chaser Propulsion System</b> Sierra Nevada Corp. recently performed incremental tests of its reaction control system under the agency’s CCiCap initiative. The RCS will help maneuver its Dream Chaser spacecraft in space.	
11	<b>December 2014: Boeing Covers Groundwork in Second Crew Transportation Contract Milestone</b> The Ground Segment Critical Design Review marks the second milestone in the company’s CCiCap contract, NASA’s Launch America initiative designed to return human spaceflight launches to the U.S. and end our reliance on Russia.	
12	<b>December 2014: SpaceX Completes First Crew Transportation Contract Milestone</b> SpaceX has completed its first milestone under a CCiCap contract with the agency. This was the first step in the company’s path toward launching crews to the International Space Station from U.S. soil.	
13	<b>January 2015: SpaceX Pad Abort Test Article Readied for Flight</b> SpaceX prepared a test article of its Crew Dragon spacecraft for an upcoming flight that was used to simulate an emergency abort from the launch pad. The Crew Dragon is designed to carry astronauts to the International Space Station, and has the ability to abort from a launch or pad emergency and safely carry crew members out of harm’s way. The review was part of SpaceX’s CCiCap agreement with NASA’s Commercial Crew Program.	
14	<b>Jan. 10, 2015: SpaceX Commercial Resupply Mission Launches to International Space Station</b> A SpaceX Falcon 9 rocket carrying a Dragon cargo craft launched on its fifth commercial resupply mission to the International Space Station. Liftoff was at 4:47 a.m. EST from Space Launch Complex 40 at Cape Canaveral Air Force Station in Florida.	
15	<b>Jan. 28, 2015: NASA Day of Remembrance</b> Kennedy Space Center paid tribute to the crews of Apollo 1 and space shuttles Challenger and Columbia, as well as other NASA colleagues, at the Space Mirror Memorial at the Kennedy Space Center Visitor Complex during the agency’s Day of Remembrance.	
16	<b>Jan. 31, 2015: Soil Moisture Active Passive (SMAP) Launches</b> NASA’s Soil Moisture Active Passive (SMAP) observatory launched at 9:22 a.m. EST (6:22 a.m. PST) aboard a United Launch Alliance Delta II rocket from Vandenberg Air Force Base in California. The Earth-observing satellite will collect global observations of surface soil moisture and its freeze/thaw state.	

17	<b>Feb. 11, 2015: Deep Space Climate Observatory (DSCOVR) Launches</b> A SpaceX Falcon 9 rocket launched the National Oceanographic and Atmospheric Administration's (NOAA) Deep Space Climate Observatory satellite from Cape Canaveral Air Force Station in Florida at 6:03 p.m. EST. The Launch Services Program worked closely with NOAA to launch the satellite.	
18	<b>Feb. 20, 2015: Boeing Commercial Crew Access Tower Groundbreaking</b> Boeing, United Launch Alliance, NASA and other organizations ceremonially broke ground, starting construction on the first new crew access tower at Cape Canaveral Air Force Station since the 1960s. The 200-foot-tall structure will be crucial to allowing astronauts to board Boeing's CST-100 Starliner spacecraft as it sits atop a United Launch Alliance Atlas V rocket.	
19	<b>Feb. 23, 2015: Crawler-Transporter 2 Takes Test Run on Crawlerway</b> NASA's crawler-transporter 2, also called CT-2, traveled along the crawlerway on a test run to Launch Pad 39B. Fondly referred to as the "workhorses" of the space program, both crawlers, CT-1 and CT-2, have served the agency's space programs for 50 years.	
20	<b>March 12, 2015: Magnetospheric Multiscale (MMS) Spacecraft Launch</b> NASA's four Magnetospheric Multiscale spacecraft launched aboard a United Launch Alliance Atlas V rocket at 10:44 p.m. EDT from Cape Canaveral Air Force Station in Florida. The satellites will study the phenomenon called "magnetic reconnection" as they orbit the Earth.	
21	<b>March 2015: NASA Awards Flame Trench Construction Contract</b> NASA awarded a contract to J.P. Donovan Construction of Rockledge, Florida, to construct a new flame deflector and refurbish the flame trench at Launch Pad 39B for use in future launches of the agency's Space Launch System rocket.	
22	<b>March 2015: SpaceX Prepares Historic Launch Pad for Future</b> SpaceX made significant construction progress on a new horizontal integration facility at Launch Complex 39A. The 300-foot-long structure is being built at the base of the pad on Kennedy Space Center's historic crawlerway to process the Crew Dragon spacecraft and Falcon 9 rocket for commercial crew flights. The pad facilities also will be used for launches using the Falcon Heavy rocket.	
23	<b>March 2015: NASA and SNC Add Milestone to Partnership Agreement</b> NASA's Commercial Crew Program added another milestone to its CCiCap agreement with Sierra Nevada Corp. The company's Design Analysis Cycle-6 Closeout Review will demonstrate the advancement of the Dream Chaser Space System from a Preliminary Design Review level of maturity toward a Critical Design Review level.	
24	<b>March 2015: SpaceX Engine Test Demonstrates Pad Abort Test Profile</b> SpaceX ignited two of its SuperDraco engines together at the company's Rocket Development Facility in McGregor, Texas. This specific test was a demonstration of a pad abort profile, with two SuperDraco engines igniting simultaneously and throttling.	
25	<b>April 2015: Boeing Tests its Commercial Crew Spacecraft at Langley</b> Boeing took its Starliner spacecraft mock-up and a scale model to NASA's Langley Research Center in Hampton, Virginia, for a series of tests designed to evaluate different aspects of the design. The spacecraft mock-up was dropped into Langley's Hydro Impact Basin to assess its tendencies in case it has to land in the water in the event of a contingency, for example, an unlikely launch or ascent emergency. A smaller model was used inside one of the Langley wind tunnels to determine how the air flows around the outside of the spacecraft in Earth's atmosphere and during different phases of flight.	


26	<b>April 3, 2015: Aft Skirt Electrical Umbilical Tested at Launch Equipment Test Facility</b> One of two aft skirt electrical umbilicals (ASEU) was tested using the vehicle motion simulator and data acquisition system at the Launch Equipment Test Facility at Kennedy Space Center. The ASEUs will provide electrical power and data connections to the Space Launch System rocket until it lifts off from its launch pad.	
27	<b>April 10, 2015: First New Work Platform Arrives for NASA's Space Launch System</b> A flatbed truck, carrying the first half of a new set of work platforms, arrives at the Vehicle Assembly Building at Kennedy Space Center. The platform, one-half of the K-level platforms, was fabricated by Steel LLC of Scottdale, Georgia, and assembled by Sauer Co. in Oak Hill, Florida. A total of 10 levels of new platforms, 20 platforms altogether, will surround the Space Launch System rocket and Orion spacecraft and provide access for testing and processing in High Bay 3.	
28	<b>April 13, 2015: 45th Anniversary of the Apollo 13 Mission</b> A gala celebration took place at the Kennedy Space Center Visitor Complex Saturn V Center for the 45th anniversary of the Apollo 13 mission. Attendees included Charlie Duke, lunar module backup; Jim Lovell, Apollo 13 commander; Fred Haise, Apollo 13 pilot; and flight directors Gene Kranz, Glynn Lunney and Gerry Griffin.	
29	<b>April 14, 2015: SpaceX Commercial Resupply Mission Launches to International Space Station</b> A SpaceX Falcon 9 rocket carrying a Dragon cargo craft launched on its sixth commercial resupply mission to the International Space Station. Liftoff was at 4:10 p.m. EDT from Space Launch Complex 40 at Cape Canaveral Air Force Station in Florida.	
30	<b>May 5, 2015: SpaceX Demonstrates Escape System for Crew Dragon Spacecraft</b> SpaceX demonstrated the abort system of its Crew Dragon spacecraft on a specially built platform at Space Launch Complex 40 at Cape Canaveral Air Force Station in Florida. During a two-minute test, the Dragon's eight SuperDraco engines fired and lifted the spacecraft out over the Atlantic Ocean, then jettisoned its trunk and parachuted to safety into the ocean. The test was part of SpaceX's CCiCap agreement with NASA's Commercial Crew Program.	
31	<b>May 6, 2015: Second Half of K-level Work Platforms Arrives</b> The second half of the K-level work platforms arrives at the Vehicle Assembly Building at Kennedy Space Center.	
32	<b>May 12, 2015: Construction Begins on Launch Pad 39C</b> Construction is underway on a Small Class Vehicle Launch Pad, called Launch Pad 39C, in the Launch Pad 39B area at Kennedy Space Center. The Ground Systems Development and Operations Program is overseeing the project aimed at attracting smaller aerospace companies to develop, test and launch their vehicles from Kennedy.	
33	<b>May 18-22, 2015: NASA Sixth Annual Robotic Mining Competition</b> NASA's Sixth Annual Robotic Mining Competition was held at the Kennedy Space Center Visitor Complex and featured teams of undergraduate and graduate students from 46 U.S. colleges and universities, demonstrating the mining capabilities of their excavator robots.	



34	<b>May 27, 2015: NASA Orders First Crew Rotation Mission from Boeing</b> Commercial Crew ordered its first crew rotation mission from Boeing. This is another step toward returning America's ability to launch crew missions to the International Space Station from the U.S. SpaceX received its first order in November 2015. Determination of which company will fly its mission to the space station first will be made at a later date.	
35	<b>May 29, 2015: Kennedy Space Center Visitor Complex Breaks Ground on New Attraction</b> As the U.S. Astronaut Hall of Fame celebrated its 25th anniversary, NASA's visitor complex broke ground on a new attraction, "Heroes and Legends." The new interactive attraction will focus on the early days of the Mercury missions, to the Gemini and Apollo missions, and also will feature memorabilia from the U.S. Astronaut Hall of Fame.	
36	<b>May 30, 2015: Four NASA Heroes Inducted into U.S. Astronaut Hall of Fame</b> During a ceremony at the Kennedy Space Center Visitor Complex, NASA's Associate Administrator for the Science Mission Directorate John Grunsfeld and former astronauts Steve Lindsey, Kent Rominger and M. Rhea Seddon were inducted into the U.S. Astronaut Hall of Fame, bringing the total number of Hall of Fame space explorers to 91.	
37	<b>June 2015: Mine-Resistant Ambush-Protected Vehicle Rolls through Pad Evacuation Runs</b> Engineers conducted timed runs of a Mine-Resistant Ambush-Protected (MRAP) armored vehicle at Space Launch Complex 41 at Cape Canaveral Air Force Station in Florida for potential launch pad evacuation routes as preparations for commercial crew flights move ahead. Larger and more powerful than the shuttle-era M113, the MRAP offers a mobile bunker to astronauts and ground crews in the unlikely event they have to get away from the launch pad quickly in an emergency.	
38	<b>June 3, 2015: Crane Modifications Completed in the Vehicle Assembly Building</b> Modifications to the 175-ton crane were completed in the Vehicle Assembly Building. The upgraded crane was lifted by crane and returned to its original position at Level 16, about 160 feet above the transfer aisle.	
39	<b>June 3, 2015: RESOLVE Team First User of New Launch Control Center Firing Room 4</b> A simulation test of the Regolith and Environment Science and Oxygen and Lunar Volatiles Extraction (RESOLVE) payload for a future Resource Prospector mission to the moon was the first user of one of four new control rooms in Firing Room 4 of the Launch Control Center.	
40	<b>June 15-19, 2015: Emergency Response Team Members Compete in SWAT Roundup</b> Members of Kennedy Space Center's Emergency Response Team competed in and placed fourth in the annual International SWAT Roundup in Orlando, Florida. ERT members prepared for the competition by practicing the skills that are part of the competition.	
41	<b>June 22, 2015: NASA Signs Agreement with Space Florida</b> NASA signed a 30-year property agreement with Space Florida, the aerospace and spaceport development authority for the state of Florida, for the operations and management of the Shuttle Landing Facility.	

42	<b>June 27, 2015: New Exhibit Opens at Kennedy Space Center Visitor Complex</b> A new exhibit, "Forever Remembered," officially opened inside the Space Shuttle Atlantis exhibit hall at the Kennedy Space Center Visitor Complex. The exhibit includes artifacts loaned by the families of each of the astronauts from space shuttles Challenger and Columbia.	
43	<b>July 9, 2015: NASA Selects Astronauts for First U.S. Commercial Spaceflights</b> Four astronauts will train to fly commercial crew flight tests aboard the Boeing CST -100 Starliner and SpaceX Crew Dragon spacecraft. Bob Behnken, Eric Boe, Doug Hurley and Suni Williams were selected to be the first astronauts to board those spacecraft.	
44	<b>July 17, 2015: New Launch Pad 39C Completed</b> Center Director Bob Cabana helped cut the ribbon to mark the official completion of the new Small Class Vehicle Launch Pad, designated 39C, in the Launch Pad 39B area. The Ground Systems Development and Operations Program oversaw construction of the new pad.	
45	<b>July 13, 2015: Interim Cryogenic Propulsion Stage Umbilical Tested at Coastal Steel</b> The Interim Cryogenic Propulsion Stage Umbilical (ICPSU) underwent a load test at Coastal Steel in Cocoa, Florida, to simulate the effects of a launch on the structure. The ICPSU will be located at about the 240-foot-level of the mobile launcher tower and will supply fuel, oxidizer, pneumatics, hazardous gas leak detection, electrical commodities and environmental control systems to the interim cryogenic propulsion stage of the Space Launch System rocket during launch.	
46	<b>July 2015: Domes Arrive for Starliner Test Article Assembly</b> The two domes that will form the pressure shell of the structural test article (STA) for Boeing's CST-100 Starliner spacecraft arrived at Kennedy Space Center. The STA Crew Module will be assembled inside a former space shuttle hangar, known as Orbiter Processing Facility-3, so the company can validate the manufacturing and processing methods it plans to use for flight-ready Starliner vehicles.	
47	<b>August 2015: NASA Awards Contract for Work on Mobile Launcher</b> NASA awarded a new Ground Support Equipment Installation Contract to J.P. Donovan Construction in Rockledge, Florida, for work on the mobile launcher to accommodate the size and weight of NASA's Space Launch System rocket.	
48	<b>August 2015: Crew Dragon Simulated Flight</b> SpaceX powered up its Crew Dragon avionics test bed at its headquarters in Hawthorne, California, and simulated a crew flight to the space station. During the avionics functionality check, engineers were able to make sure the spacecraft's hardware and software worked well together in a flight-like environment. The avionics are known as the brains of a spacecraft, controlling all the critical automated operations of a flight.	
49	<b>Aug. 5, 2015: SpaceX Completes Road to Launch Pad</b> SpaceX completed the road at Launch Pad 39A from its processing hangar to the top of the launch stand. A transporter-erector will move the Falcon 9 and Falcon Heavy rockets to position them above the flame trench for liftoff on flights carrying astronauts to the space station and other launches.	

50	<b>Aug. 26, 2015: Boeing Wraps Historic Processing Facility</b> One of the former processing bays for the space shuttles got a facelift as Boeing wrapped the building that will be the production and processing home of its Starliner spacecraft. The interior of the Commercial Crew and Cargo Processing Facility, better known as C3PF, was outfitted for the precision demanded in assembling human-rated spacecraft and then processing the craft for flight. The wrap, which covers the front of the processing bay, showcases the future Boeing intends to pursue with the Starliner line.	
51	<b>September 2015: Orion Service Module Umbilical Tested</b> The Orion service module umbilical (OSMU) was positioned and readied for testing on one of the Vehicle Motion Simulators at the Launch Equipment Test Facility at Kennedy Space Center. The OSMU will connect to the Orion spacecraft from the 280-foot level of the mobile launcher tower and will transfer liquid coolant for electronics and air for the environmental control system to the spacecraft's service module.	
52	<b>Sept. 4, 2015: Grand Opening of Boeing Commercial Crew and Cargo Processing Facility</b> Boeing's new processing facility for its CST-100 Starliner spacecraft, also known as C3PF, was officially opened during a ceremony attended by NASA Administrator Charlie Bolden. Boeing is one of two companies under contract with NASA's Commercial Crew Program to launch crews to the International Space Station from the U.S.	
53	<b>Sept. 9, 2015: Crew Access Tower Stacking Begins</b> The first new Crew Access Tower at Cape Canaveral Air Force Station in Florida since the Apollo era took shape at Space Launch Complex 41 as workers moved the first two tiers from a nearby construction yard to the pad surface. The tiers were lifted into place atop each other at the foot of the launch pad.	
54	<b>Sept. 11, 2015: 9/11 Beam Dedication</b> A memorial to the 343 first responder victims of the Sept. 11, 2001, terrorist attacks was dedicated at Fire Station 1 at Kennedy Space Center. A section of steel I-beam from the World Trade Center in New York forms the centerpiece of the monument.	
55	<b>Sept. 15, 2015: J-level Work Platform Arrives at Kennedy Space Center</b> The first half of the J-level work platforms for NASA's Space Launch System rocket arrived at Kennedy Space Center from Sauer Co. in Oak Hill, Florida. The platform will be installed in High Bay 3 of the Vehicle Assembly Building.	
56	<b>Sept. 15, 2015: Blue Origin to Build and Launch Rockets from Space Coast</b> Jeff Bezos, founder and CEO of Blue Origin, speaks during an event at Space Launch Complex 36 at Cape Canaveral Air Force Station in Florida for the announcement that the company will build rockets at Exploration Park near Kennedy Space Center and launch them from Space Launch Complex 46 at the Cape.	
57	<b>Sept. 17, 2015: Construction Begins on Central Campus Building</b> A tower crane was completed above the construction site of the Central Campus building at Kennedy Space Center as the structural construction phase begins for the seven-story building. The new structure will be more energy efficient than the current headquarters building and will feature the latest in office and administrative building technology to fulfill Kennedy's role as the premiere spaceport for NASA and, increasingly, commercial entities.	

58	<b>Sept. 23, 2015: Operations and Maintenance Support Services Contract Awarded</b> NASA awarded a contract to URS Federal Services Inc., of Germantown, Maryland, to operate and maintain three UH-1H-II aircraft and associated aerospace ground equipment at Kennedy Space Center.	
59	<b>Sept. 25, 2015: Crew Access Tower Stacking Passes Midway Point</b> The fourth of seven sections of the Crew Access Tower were stacked to prepare for Boeing's Starliner spacecraft. Built four miles south, each section, or tier, was trucked to United Launch Alliance's Atlas V launch pad where a crane lifted them into position. The tower will reach about 200 feet high when it's finished.	
60	<b>Oct. 1, 2015: 'So You Want to be a Martian' Panel Discussion</b> NASA scientists, engineers, former astronauts and cast members from "The Martian" participated in a panel session at Kennedy Space Center that focused on the agency's Journey to Mars.	
61	<b>Oct. 2, 2015: Second J-level Work Platform Delivered to Kennedy Space Center</b> The second half of the J-level work platforms for High Bay 3 in the Vehicle Assembly Building arrived at Kennedy Space Center.	



NASA's mobile launcher casts a reflection on the surface of an inland waterway in this sunrise photograph taken on April 1, 2015 at Kennedy Space Center in Florida. To the right is the Vehicle Assembly Building. The Ground Systems Development and Operations Program at Kennedy is overseeing upgrades and modifications to the mobile launcher so it can carry the agency's Space Launch System and Orion Spacecraft to Launch Pad 39B.





# Center Planning & Development



NASA’s Kennedy Space Center has been on an accelerated path of transforming itself from a government-only launch site to a multi-user spaceport and in 2015 it has come to fruition.

Kennedy now is a place where government and commercial space industry are present and actively pursuing regular, safe access to space. The vision of the 20-year Master Plan for the center is to increase and expand the capabilities for all potential users and to provide a more commercially friendly environment for the rising commercial space industry. All of this has been accomplished while preparing for the launch and operations of the new NASA Space Launch System which will propel humans further outward into the solar system than ever before with the goal of putting humans on the planet Mars.

And because of this, a number of significant milestones were met in 2015.

First, the Shuttle Landing Facility (SLF) officially was turned over to the State of Florida for operations and maintenance. The SLF will continue to be a focus for partnership potential and is finding a niche role as a technology test bed to perfect terrestrial technology, from hosting the world’s fastest cars to helping companies refine machinery. This offers a glimpse of future exploration in the form of landers using experimental devices and flying over the SLF’s expanse. Under the management of Space Florida, the State of Florida’s space development agency, there is expected to be a significant expansion of activities and functions in the coming years.

Construction was completed in FY 2015 on a new Small

Class Vehicle Launch (SCVL) Pad, designated 39C, in the southeast area inside the perimeter of Launch Pad 39B. The launch pad is designed to attract smaller aerospace companies and enable them to develop and launch their vehicles from Kennedy. The Ground Systems Development and Operations Program oversaw construction of the pad and is working with Center Planning and Development to grow commercial space efforts at Kennedy. The new SCVL pad features a concrete pad and universal propellant servicing system, with room for a customer-provided launch mount.

In FY 2015, the second Commercial Resupply Services 2 contract (CRS2) was awarded to three commercial space companies. At least two of these companies, SpaceX and Sierra Nevada, are expected to launch from the Space Coast and Kennedy. SpaceX is one of the original awardees of the CRS2 contract and the award will assure that Kennedy is still in the forefront of servicing the International Space Station.

◀ NASA Kennedy Space Center Director Bob Cabana, center, helps cut the ribbon on the new Small Class Vehicle Launch Pad, designated 39C, on July 17, 2015. Also helping to cut the ribbon are, from left, Pat Simpkins, director, Engineering and Technology Directorate; Rich Koller, senior vice president of design firm Jones Edmunds; Scott Colloredo, director, Center Planning and Development; and Michelle Shoultz, president of Frazier Engineering.

Sierra Nevada is a new entrant into this activity and will be performing their missions with a new vehicle, the Dream Chaser. This vehicle will launch vertically but return to Earth like a plane, much as the space shuttle did when it was operating. This will provide for two ways to send cargo to the International Space Station and also allow for materials to be returned safely to Earth. It is expected that this vehicle will land at the SLF, thus increasing the activities there.

Also in FY 2015, Blue Origin, another commercial launch provider, announced they would be constructing a launch complex on the Space Coast for their New Shepard launch vehicle. But perhaps more importantly for Kennedy, the company said it also would be constructing a large manufacturing facility in Exploration Park, an industrial and technology park on Kennedy property just outside the secured perimeter, where the recently unveiled launch vehicle and the New Shepard orbital vehicle will be manufactured. This represents the first time that a launch vehicle will be developed, manufactured, processed and launched from the Space Coast. This is a major milestone for Kennedy as it looks to expand its number of partnerships with the government and commercial space industry to continue to be the world’s premier multi-user spaceport. ✨



This aerial photo of the Shuttle Landing Facility runway at Kennedy Space Center was taken April 30, 2014. Space Florida President and CEO Frank DiBello signed an agreement with Kennedy Space Center Director Robert Cabana on June 22, 2015, for a 30-year property agreement for the operations and management of the historic Shuttle Landing Facility. Space Florida is the aerospace and spaceport development authority for the state of Florida. The property agreement with Space Florida will allow a variety of commercial and government partners to use the three-mile-long runway.





# Commercial Crew Program

NASA and partners in the aerospace industry took new, bold steps during fiscal year 2015 to return America’s capability to launch its astronauts from American soil to the International Space Station. Selected 14 days before the start of the new fiscal year to partner with the space agency, Boeing and SpaceX used 2015 to set a course for the final phases of development of their spacecraft and launch systems.

The program’s goal remained to produce two, independent commercially built, owned and maintained crew transportation systems, each capable of carrying up to four astronauts and about 220.5 pounds of critical cargo to the International Space Station.

In fiscal year 2016, Boeing and SpaceX are expected to build independent crew transportation systems in partnership with NASA’s Commercial Crew Program. In addition to funding, NASA has provided spaceflight expertise throughout the development phases and issued requirements for the spacecraft. During the final development phase heading into

flight, NASA will continue to provide guidance and will confirm that the companies are meeting the requirements for the milestones and missions.

Boeing is building the CST-100 Starliner spacecraft to launch atop a United Launch Alliance Atlas V rocket and SpaceX is working on the Crew Dragon spacecraft and Falcon 9 rocket. These new vehicles will be able to carry up to four crew members, which would increase the station’s crew size by one, bringing the total size of a station expedition to seven. It might not sound like much of an increase, but that additional person will be able to double the amount of time astronauts can devote to performing scientific research on the station.

Once they reach the space station, the additional astronauts will continue their groundbreaking research in space to improve life on Earth and help decipher the challenges of long-duration spaceflight for astronauts.

But before any of that can happen, NASA, Boeing and SpaceX will have to continue to refine their designs and test them stringently, build test articles and perform an unpowered,



*Doug Hurley, from left, Eric Boe, Bob Behnken and Sunita “Sunni” Williams have been selected to be the first astronauts to train for test flights to the International Space Station on Boeing’s CST-100 and SpaceX’s Crew Dragon. Standing at Johnson Space Center in Houston, training base for NASA’s astronaut corps, the crew posed together for the first time July 20, 2015, since the announcement was made. Working shoulder-to-shoulder with engineers in the agency’s Commercial Crew Program, the astronauts will be instrumental in the final development and certification of new commercially owned and operated American space systems.*



*On June 11, 2015, SpaceX released a new photo showing the progress the company is making on an assembly hangar at Kennedy’s historic Launch Complex 39A. The company says the building will be big enough to house five Falcon rockets at once. The launch pad is being outfitted for missions by the Falcon Heavy and for Commercial Crew flights using the Falcon 9 rocket launching Crew Dragons to the International Space Station with NASA astronauts aboard.*

followed by a piloted, flight test. After succeeding in those steps, operational missions to the station can begin to enhance research off the Earth to benefit all those on the Earth.

Both companies began adapting their integrated designs into flight test versions of spacecraft and launch vehicles, as well as building and modifying the infrastructure needed to manufacture vehicles and launch astronauts in the near future.

Working through their final phases of development during the fiscal year, Boeing’s and SpaceX’s teams began the year with an eye on setting the stage for initial flight tests in the future and then up to six operational missions apiece.

During the fiscal year, SpaceX conducted a flight test with its Crew Dragon spacecraft under the company’s Commercial Crew Integrated Capability Space Act Agreement with NASA. The successful pad-abort test from Space Launch Complex 40 at Cape Canaveral Air Force Station in Florida showed that the company’s eight SuperDraco thrusters are powerful enough to lift the

*Parts of the Boeing CST-100 Structural Test Article rest on test stands inside the Commercial Crew and Cargo Processing Facility, or C3PF, at NASA’s Kennedy Space Center in Florida on Sept. 3, 2015. The test article will serve as a pathfinder for assembling and processing operational CST-100 spacecraft inside the revitalized facility, which for 20 years served as a shuttle processing hangar.*



spacecraft and its crew away from a failing booster and out of danger in the unlikely event of an emergency at the pad or during launch and ascent.

Boeing and SpaceX started modifications on historic launch pads Space Launch Complex 41 and Pad 39A, respectively, along Florida’s Space Coast in preparation for their missions to the station. These facilities were used for 50 years to send numerous robotic craft and probes to the outer solar system, as well as Apollo and space shuttle missions.

The Starliner’s launch pad also saw extensive construction as workers started to build the 200-foot-tall Crew Access





Boeing took its CST-100 spacecraft mock-up and a scale model to NASA's Langley Research Center in Hampton, Virginia, for a series of tests designed to evaluate different aspects of the design. The full-scale version of the spacecraft was dropped into water at Langley on March 12, 2015, to judge how the spacecraft would behave in case it had to make a quick return to Earth and could not land on the ground. The CST-100 is designed to descend from orbit under parachutes with inflatable bags cushioning the landing for crew members inside.



The fourth tier of the Crew Access Tower is lifted into place at Space Launch Complex-41 on Sept. 22, 2015. Boeing and United Launch Alliance are working together to construct the tower. The steel structure is being built in seven pieces that will be stacked atop each other to form a 200-foot-tall tower complete with elevator, communications and power infrastructure, and an escape system. The tower will provide astronauts and ground support teams access to Boeing's CST-100 Starliner spacecraft, in development in partnership with NASA's Commercial Crew Program.

Tower at Space Launch Complex 41. The tower will allow astronauts and ground crews access to the spacecraft as it stands ready for liftoff on top of the rocket. Built in segments a short distance from the pad, the tower was constructed between launches so as not to interfere with the busy operational Atlas V launch complex. Starliners will launch aboard United Launch Alliance Atlas V rockets. The build of the Crew Access Arm and White Room for the tower also began during the year. The arm will be a bridge for astronauts boarding the Starliner and the White Room will give them and support crews an area to make final preparations before heading into space.

SpaceX began modifying Launch Complex 39A at Kennedy Space Center during fiscal year 2015 for its Falcon 9 and Falcon Heavy rockets, as well as the unique needs of human launch. The modifications began with a new horizontal launch processing facility at the base of the launch pad and installation of a set of rails. The hangar is designed to shelter a transporter-erector along with several Falcon 9 rockets and core stages as they are processed before launch. Following on the work performed during FY 2015, SpaceX was on pace to update the flame trench and hardstand with the mechanisms to lift the rockets into place, and take unneeded weight off the fixed service structure and remove the rotating service structure at the pad.

Boeing refurbished the former Orbiter Processing Facility-3 from a space shuttle hangar to a factory capable of assembling, manufacturing and processing its CST-100 Starliner spacecraft for launch. The manufacturing location employs modern techniques in spacecraft construction. It will be the location where the spacecraft elements enter at one end, and complete, space-ready Starliners leave the other ready to be mounted to the top of a United Launch Alliance Atlas V rocket and launched into orbit.

While much of the work at Kennedy revolved around launch site and facility modifications, the program as a whole also paid close attention to system development. Boeing and SpaceX have goals and milestones to complete as development progresses from the design shop to

➤ In the high bay of the Neil Armstrong Operations and Checkout Building at NASA's Kennedy Space Center, NASA Administrator Charlie Bolden delivers a "State of NASA" address Feb. 2, 2015, during a fiscal year 2016 budget rollout event. Seated to Bolden's left is Kennedy's director, Bob Cabana. Representatives from the spaceport's workforce, news media and social media were in attendance. On display in the background, from left, are Boeing's CST-100, NASA's Orion and the SpaceX Dragon spacecraft, all destined to play a role in the agency's exploration objectives.

the manufacturing hall. Each contract is different depending on what the respective companies offered, and both completed numerous steps in fiscal year 2015 to prepare for flight tests.

In July, NASA announced the first astronauts to train to fly on commercial crew vehicles. All boasting test pilot experience and prior missions on the station and shuttle, Bob Behnken, Eric Boe, Doug Hurley and Suni Williams worked with Boeing and SpaceX to help the companies finalize their spacecraft, crew systems and other elements. NASA's astronaut corps also played an extensive role in the Commercial Crew Program from evaluating the systems, to practicing scenarios with the partners and event management tasks in the program.

The conversions and advances were not limited to Earth. Astronauts on the International Space Station began preparing the orbiting laboratory for the International Docking Adapters that the Starliner and Crew Dragon with use for flight tests and operational missions. Performing spacewalks on the outside of the station, astronauts re-routed wiring for power and data systems. They also repositioned cameras and other television equipment to provide a view of the spacecraft as they approach and dock to the station.

Taken together, the accomplishments of FY 2015 have set the stage for human spaceflight in the near future that takes the best of industrial innovation and combines it with NASA's hard-earned expertise in human space exploration. ✨

➤ On Jan. 26, 2015, engineers and technicians at the SpaceX facility in Hawthorne, California, prepare the test version of the company's Crew Dragon for a pad abort test at Cape Canaveral, Florida.



▲ Eight SuperDraco engines boost a SpaceX Crew Dragon spacecraft away from Space Launch Complex 40 at Cape Canaveral Air Force Station in an emergency pad abort simulation on May 6, 2015. Each of the eight SuperDraco engines generates 15,000 pounds of thrust and burns about six seconds. The test began at 9 a.m. After the engines shut down, the Dragon spacecraft's trunk, with passive fins for stability, separated when it reached peak altitude.





# COMMERCIAL CREW BENEFITS

Transforming Human Spaceflight for Future Generations

## Cost-Effective

*Developing safe, reliable crew transportation to the International Space Station that reduces reliance on foreign systems.*

SPACEX CREW DRAGON & BOEING CST-100 STARLINER



**\$58 MILLION**  
per seat



RUSSIAN SOYUZ  
**\$81 MILLION**  
per seat



# Launch Services Program

NASA's Launch Services Program (LSP) at the Kennedy Space Center supported four missions during Fiscal Year 2015 as part of the agency's programs that are making a difference in the lives of people around the world. Additionally, LSP is supporting projects that will provide broader access to space.

The year was highlighted by the first launch of NASA's Orion spacecraft and arrival of the agency's New Horizons spacecraft at Pluto.

During FY 2015, LSP engineers played an advisory role in preparations for the first test flight of NASA's new Orion spacecraft. On Dec. 5, 2014, a Delta IV Heavy launched the Orion spacecraft, sending it 3,600 miles beyond Earth. During the two-orbit, four-hour Exploration Flight Test-1, engineers were able to evaluate the systems critical to crew safety, the launch abort system, the heat shield and the parachute system. Data gathered during the mission will influence design

▼ *The SpaceX Falcon 9 rocket carrying NOAA's Deep Space Climate Observatory spacecraft, or DSCOVR, lifts off Feb. 11, 2015, from Space Launch Complex 40 at Cape Canaveral Air Force Station in Florida. DSCOVR is a partnership between NOAA, NASA and the U.S. Air Force, and will maintain the nation's real-time solar wind monitoring capabilities.*



decisions and validate existing computer models.

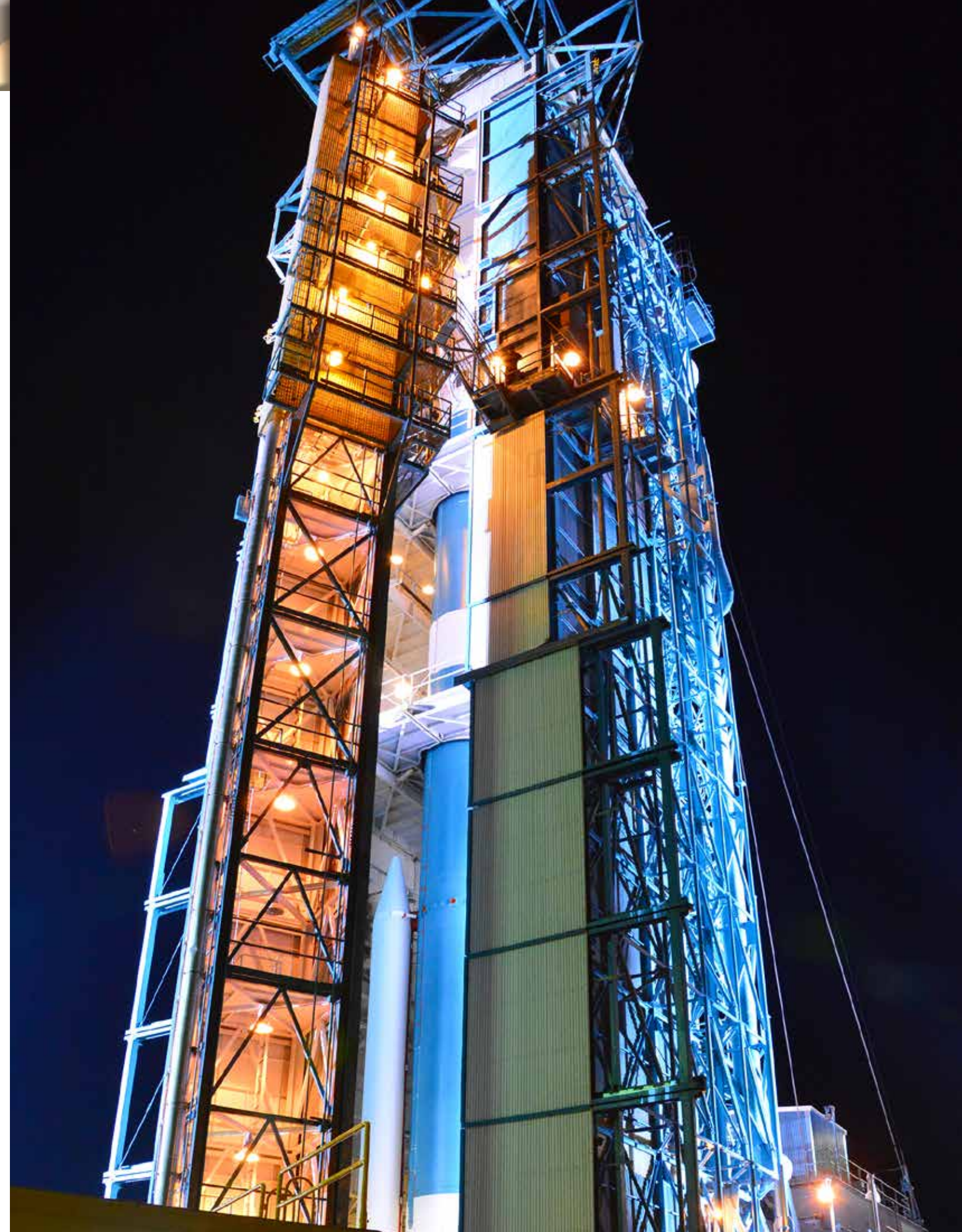
Prior to launch on Jan. 19, 2006, LSP prepared New Horizons and its Atlas V launch vehicle for an unprecedented journey of over 3.6 billion miles to the farthest reaches of the solar system. On June 2, 2015, Kennedy employees heard a panel discussion with key individuals who supported the New Horizons mission, including principal investigator Alan Stern, Ph.D., of the Southwest Research Institute, and LSP representatives. The panel discussed expectations for the New Horizons flight through the Pluto system, which began July 14, 2015, and produced stunning images of the planet's surface.

On Jan. 31, 2015, a United Launch Alliance (ULA) Delta II rocket lifted off with NASA's Soil Moisture Active Passive, or SMAP, observatory aboard. Launched from Vandenberg Air Force Base in California, SMAP is the agency's first Earth-observing satellite designed to collect global observations of surface soil moisture and its freeze/thaw state.

LSP also worked closely with NOAA, the National Oceanographic and Atmospheric Administration, on the Feb. 11, 2015, launch of the Deep Space Climate Observatory, or DSCOVR, satellite. Lifting off from Cape Canaveral Air Force Station atop a SpaceX Falcon 9 rocket, NASA was responsible for both the launch and activation of the spacecraft. The nation's first operational satellite in deep space, DSCOVR orbits a million miles away at a location called Lagrange Point 1, or L1. This location is a gravity neutral point in space, allowing DSCOVR essentially to hover between the sun and Earth, providing forecasters with higher-quality measurements of solar wind.

On March 12, 2015, NASA launched four Magnetospheric Multiscale, or MMS, spacecraft from the Cape on a ULA Atlas V rocket. The MMS satellites now are positioned in Earth

► *The launch gantry is rolled back Jan. 28, 2015, to reveal the United Launch Alliance Delta II rocket with the Soil Moisture Active Passive satellite, or SMAP, aboard, at Space Launch Complex 2 on Vandenberg Air Force Base in California. SMAP is a remote sensing mission designed to measure and map the Earth's soil moisture distribution and freeze/thaw state with unprecedented accuracy, resolution and coverage.*







*NASA's New Horizons spacecraft roars off Cape Canaveral's Launch Complex 41 atop an Atlas V rocket on Jan. 19, 2006, for its journey to Pluto. The New Horizons flight through the Pluto system began July 24, 2015, and produced stunning images of the planet's surface.*

orbit becoming the first mission dedicated to the study of a phenomenon called “magnetic reconnection.” This process is thought to be the catalyst for some of the most powerful explosions in the solar system, affecting space weather. These create what is called a geomagnetic storm that can interrupt the work of satellites, which play crucial roles in everyday life.

In October 2015, LSP awarded multiple Venture Class Launch Services contracts to provide small satellites – also called CubeSats, microsats or nanosatellites – access to low-Earth orbit. This program is designed to encourage the small launch vehicle market to expand.

The three companies selected to provide these new commercial launch capabilities are Firefly Space Systems Inc. of Cedar Park, Texas; Rocket Lab USA Inc. of Los Angeles; and Virgin Galactic LLC of Long Beach, California.

Small satellites, such as CubeSats, are playing an increasingly important role in exploration, technology demonstration, scientific research and educational investigations. These miniature spacecraft provide a low-cost platform for missions for various organizations, especially educational groups.

During the past year, LSP partnered with students, teachers and faculty at all academic levels in a program called Educational Launch of Nanosatellites, or ELaNa. These projects are designed, built and operated by students at elementary

and high schools, along with colleges and universities. The experience gives them hands-on flight hardware development experience and a low-cost pathway to conduct research.

ELaNa CubeSats were included on multiple launches in 2015, including SMAP, the National Reconnaissance Office's L-55 mission launched on Oct. 8 from Vandenberg, and the Orbital ATK Commercial Resupply Services-4 mission launched Dec. 6 from the Cape.

During 2015, LSP certified SpaceX's Falcon 9 as a medium-risk launch vehicle able to carry agency spacecraft such as Jason-3.

After Jason-3, there will be three more launches planned for 2016. The Origins, Spectral Interpretation, Resource Identification, Security-Regolith Explorer, or OSIRIS-REx, is a spacecraft that will be launched to an asteroid and bring a small sample back to Earth for study.

On June 18, 2015, the Jason-3 spacecraft arrived at Vandenberg aboard a Boeing 747 transport aircraft, concluding a journey from the Thales Alenia Space manufacturing facility in France. After launch atop a SpaceX Falcon 9 rocket, Jason-3 will be the fourth in a series of spacecraft providing scientists with essential information about global and regional changes in the seas.

The GOES-R, for Geostationary Operational Environmental Satellite-R series, is the next generation of geostationary

➤ *In a clean room at the Astrotech Space Operations facility in Titusville, Florida, preparations are underway Feb. 23, 2015, to enclose NASA's Magnetospheric Multiscale observatories (MMS) in an Atlas payload fairing for launch.*

weather satellites. The advanced spacecraft and instrument technology used on the GOES-R series will result in more timely and accurate forecasts and warnings.

Additionally, the Cyclone Global Navigation Satellite System, or CYGNSS, will be boosted to orbit by a Pegasus rocket launched from Orbital ATK's L-1011 aircraft. The University of Michigan is responsible for directing all aspects of the CYGNSS mission which will use a constellation of eight microsatellite observatories designed to study hurricanes and much more.

In March 2015, NASA selected United Launch Services of Centennial, Colorado, to provide launch services for the agency's Solar Probe Plus (SPP) mission. The SPP spacecraft is scheduled to lift off from the Cape in 2018 aboard a Delta IV Heavy rocket at the opening of a 20-day launch period. SPP will be the first mission to fly through the solar corona, the sun's outer atmosphere, to examine two fundamental aspects of solar physics: Why the corona is so much hotter than the sun's surface and what accelerates the solar wind that affects Earth and the solar system.

Another LSP highlight during the past year was selection of the organization's director, Amanda Mitskevich, as recipient of the prestigious Kurt Debus Award.

The National Space Club Florida Committee's Kurt Debus Award honors achievements of individuals who have made significant contributions to aerospace in the areas of launch vehicles, spacecraft operations, ground support services, range activities, and space education, as well as spaceport research and development. Mitskevich was credited for her LSP leadership, including managing more than 30 successful launches on a variety of rockets.

NASA's Launch Services Program ensures the nation has dependable access to space for launching probes to low-Earth orbit and beyond. LSP also is part of the agency's exceptional team of experts with decades of experience in innovative technology and compelling scientific research. ✨



▼ *The Jason-3 satellite is lifted from its shipping container June 20, 2015, in the Payload Processing Facility at Space Launch Complex-4 East at Vandenberg Air Force Base in California. Data from Jason-3 will provide information about oceans that forecasters need to better predict severe weather and devastating hurricanes before they arrive onshore.*







# Ground Systems Development & Operations Program



Not since NASA prepared Kennedy Space Center's facilities for the Space Shuttle Program 35 years ago has there been such a large-scale effort to ready the center in anticipation of the launch of the agency's Space Launch System (SLS) rocket and Orion spacecraft on Exploration Mission 1 (EM-1). The Ground Systems Development and Operations Program (GSDO) and support contractors at the center are busier than ever as work continues to transform Kennedy into a multi-user spaceport that can support both government and commercial launches.

During the year, four new work platform assemblies for the SLS were delivered to the center for installation in High Bay 3 of the Vehicle Assembly Building. The first half of the K-level platforms was installed above the floor of the high bay in late 2015. A total of 10 levels of work platforms, 20 platform halves altogether, will surround the SLS rocket and Orion spacecraft and give engineers and technicians access to various areas of the giant rocket, twin solid rocket boosters, the spacecraft and its launch abort system during processing and testing.

As each set of platforms is installed, they will be powered on, and extended and retracted to test their functionality and simulate how they will surround the massive rocket and Orion on the mobile launcher.

The landscape at Launch Pad 39B has changed significantly. A clean pad concept has replaced the configuration once used for space shuttle launches. The pad's surface has been completely upgraded. New crawler track panels have been installed and concrete repairs are complete. Below the pad, the flame trench walls have been resurfaced and work has begun applying new heat-resistant brick walls.

*A crane high above is used to lift the 175-ton crane up to its original position, Level 16, above the transfer aisle inside the Vehicle Assembly Building at Kennedy Space Center on June 3, 2015. The crane's 45-year-old controls were upgraded to improve reliability, precision and safety.*



*A technician monitors the progress of NASA's crawler-transporter 2, also called CT-2, as it continues to move slowly along the crawlerway Feb. 20, 2015, on a test run to Launch Pad 39B at Kennedy Space Center.*

The design for a new flame deflector that will direct the heat and exhaust from the launch of the SLS rocket to the north side of the flame trench has been selected.

NASA selected J.P. Donovan Construction Inc. of Rockledge, Florida, to begin the next phase of work on the 380-foot-tall (including the base), 10.5-million-pound steel mobile launcher. More than 800 mechanical, fluid and electrical components, about 300,000 feet of cabling, and miles of tubing and piping will be installed on the ML to prepare it for the SLS rocket and Orion as they are processed in the VAB and then transported to Launch Pad 39B atop the structure.

Crawler-transporter 2 is being upgraded to support the extra load of the mobile launcher with the SLS rocket and Orion for the trip to the launch pad. The crawler's old generators were previously removed and new generators were installed. Upgrades to the 16 jacking, equalization, and leveling cylinders were completed. The crawler's new roller bearings passed a verification and validation test, and renovation of the gearboxes was completed at the end of 2014.

At the Launch Equipment Test Facility (LETF), GSDO engineers tested the Orion Service Module Umbilical (OSMU) and two Aft Skirt Electrical Umbilicals (ASEU).

The OSMU will connect from the mobile launcher tower to the SLS rocket and Orion spacecraft to provide power, communications, coolant and fuel. Attached to the facility's Vehicle Motion Simulator, the OSMU was put through a series of tests that simulated the motion that the umbilical would

*Preparations are underway April 3, 2015, to test the aft skirt electrical umbilical (ASEU), the small, gray cone-shaped structure on the ground, at the Launch Equipment Test Facility (LETF) at Kennedy Space Center. The ASEU will connect to the mobile launcher and provide electrical power and data connections to the Space Launch System boosters.*







*NASA's crawler-transporter 2, also called CT-2, moves along the crawlerway Feb. 19, 2015, on a test run to Launch Pad 39B at Kennedy Space Center. In the background is the mobile launcher that will be used along with the crawler to move NASA's Space Launch System (SLS) with Orion on top to pad B.*



*A flatbed truck, carrying the second half of a new set of work platforms arrives May 6, 2015, at the Vehicle Assembly Building (VAB) at Kennedy Space Center. The platform, the other half of the "K" platforms, was fabricated by Steel LLC of Scottsdale, Georgia, and assembled by Sauer Co. in Oak Hill, Florida. A contract to modify High Bay 3 in the VAB was awarded to Hensel Phelps Construction Co. of Orlando, Florida, in March 2014.*

experience from rollout through about the first half-second of launch, when the umbilical is disconnected.

The ASEUs will connect to the SLS rocket at the bottom outer edge of the booster, referred to as the aft skirt. They will act like a telephone line and carry a signal to another subsystem on the mobile launcher called the Launch Release System. This system distributes the signal to the rest of the umbilicals and the SLS boosters give the release command just before launch. During the test, the ASEUs were connected to the facility's Data Acquisition System and Vehicle Motion Simulator to test their design and function.

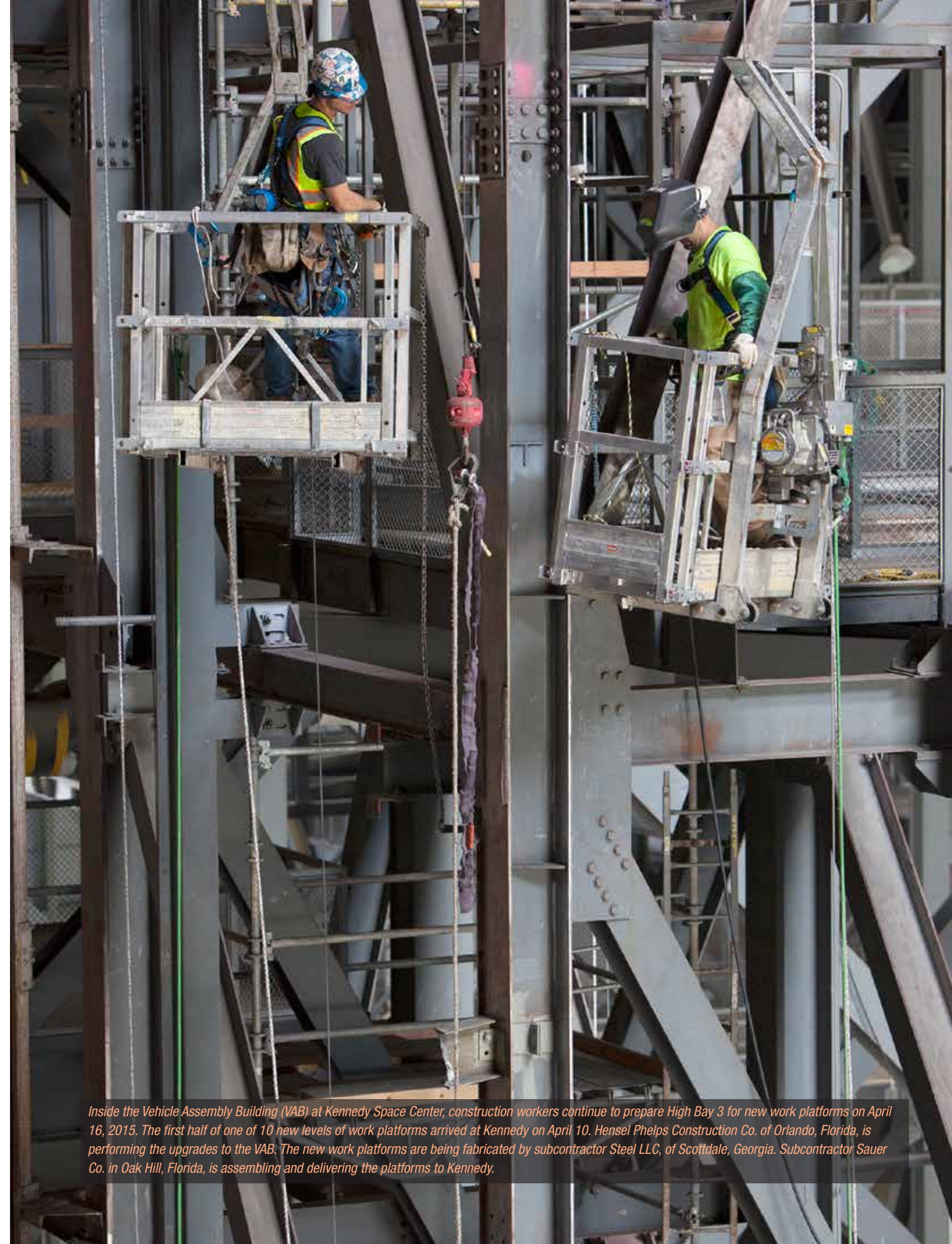
Inside the VAB, construction upgrades were completed on the 175-ton crane and its control system. The crane then was lifted out of the VAB transfer aisle and installed onto its mounting rails on Level 16, or about 196 feet above the floor of the facility. The 175-ton crane will be used to process the SLS rocket in the VAB transfer aisle.

The GSDO team also made progress on the completion of modifications to the Multi-Payload Processing Facility and ground support equipment fabrication and installation. Access stands were delivered and installed to support offline hazardous processing and deservicing of the Orion spacecraft.

The aft skirts and booster segments for the SLS rocket's twin solid rocket boosters will be processed in the Rotation, Processing and Surge Facility. Platform modifications to support the new booster configuration for the SLS rocket were completed. Final verification and validation of the platforms were completed last spring.

A major software release for Firing Room 1 in the Launch Control Center was completed and will be configured for testing. The software is critical for testing Kennedy's ground subsystems in order to process and launch the SLS rocket and Orion spacecraft.

GSDO continues to upgrade, modify and prepare the center's heritage facilities and ground support equipment for the arrival of the SLS rocket and Orion spacecraft for Exploration Mission 1 and future missions that will one day send astronauts on trips beyond low-Earth orbit and the journey to Mars. ✨



*Inside the Vehicle Assembly Building (VAB) at Kennedy Space Center, construction workers continue to prepare High Bay 3 for new work platforms on April 16, 2015. The first half of one of 10 new levels of work platforms arrived at Kennedy on April 10. Hensel Phelps Construction Co. of Orlando, Florida, is performing the upgrades to the VAB. The new work platforms are being fabricated by subcontractor Steel LLC, of Scottsdale, Georgia. Subcontractor Sauer Co. in Oak Hill, Florida, is assembling and delivering the platforms to Kennedy.*



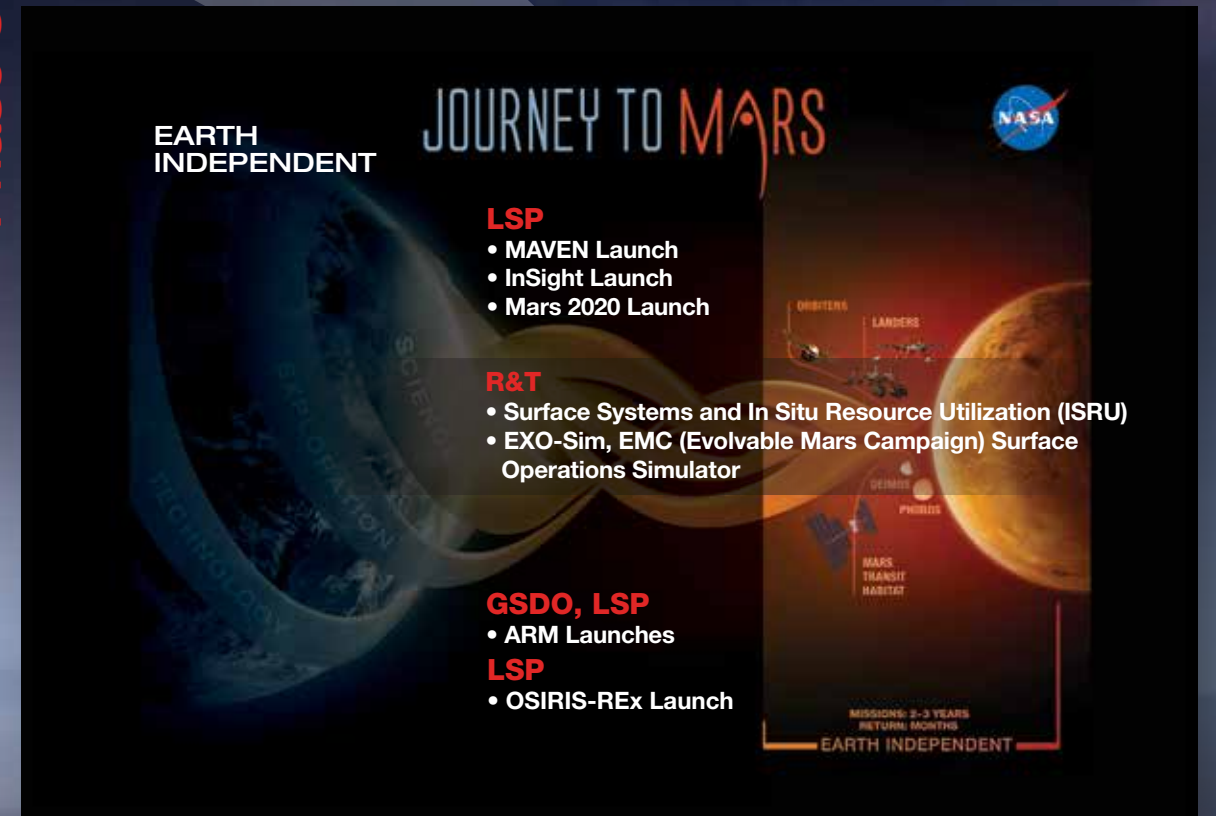
# KSC Contributions... to the Journey



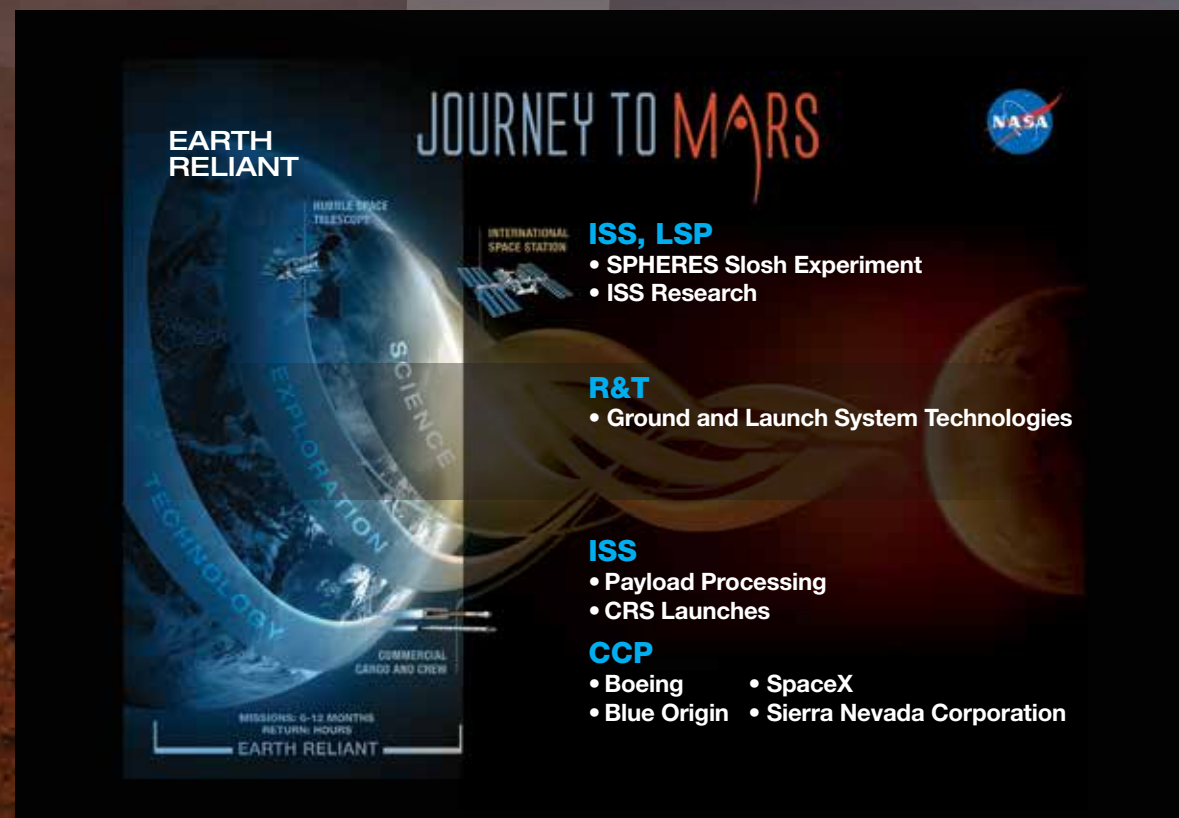
## Phase 2



## Phase 3



## Phase 1



NASA'S JOURNEY TO

# MARS

Kennedy Space Center has a rich history doing great things for America's space program. The work done here allowed us to walk on the moon, build and fly the space shuttle for thirty years, and build and maintain the International Space Station.

The center has undergone significant change; we're now better equipped to successfully accomplish a truly bold vision: exploring deep space and pioneering the red planet. Our capabilities are more flexible, our operations are more diverse, and our team is as talented and capable as ever.

We're preparing to go to Mars and this is how we're planning to do it.

-Bob Cabana



# Exploration Research & Technology

The team in the Exploration Research and Technology Directorate at the Kennedy Space Center is continuing to advance new capabilities and cutting-edge developments. They created a pipeline that takes innovations from early-stage through flight and on to use in everyday life.

Early in 2015, the agency's chief technologist, David Miller, visited some of the space center's laboratories, speaking with engineers and researchers about the projects currently in work at Kennedy. The Jan. 6, 2015, visit took him to the Cryogenic Test Laboratory, Swamp Works and the Polymer Material Sciences Lab in the Neil Armstrong Operations and Checkout Building.

Some of the research Miller saw included work to provide fresh food grown in microgravity for the crew aboard the International Space Station (ISS). A team at the Florida spaceport worked to get a flight unit developed and certified for use on the orbiting laboratory. After harvesting the first crop of "Outredgeous" red romaine lettuce from the Veggie plant growth system, a complete microbial analysis was conducted to assess its safety for consumption. The flight safety doctors determined that with some microbial control

the lettuce was safe to eat so an acceptable protocol was developed. A second crop of lettuce was grown and the station's Expedition 44 crew members sampled the fruits of their labor. This included NASA astronaut Scott Kelly, who spent a year in space.

In addition, Kennedy scientists and engineers successfully completed a plant grow out using the Advanced Plant Habitat Engineering Development Unit and plan to deliver the flight unit to ISS in December 2016.

Kennedy Exploration Research and Technology scientists and engineers also developed a process to perform high-pressure fills for a device called NORS, the Nitrogen Oxygen Recharge System. NORS is designed to be the primary provider of oxygen and nitrogen on the space station.

Oxygen and nitrogen are needed for replenishment of the ISS cabin breathing air, as well as operation of the airlock and the pressurized ammonia cooling systems. NORS will be a

*Researchers activated the Veggie plant growth system May 9, 2015, inside a control chamber at the Space Station Processing Facility at Kennedy Space Center, to shadow the activation and procedures being performed on Veggie on the International Space Station.*



*Inside Kennedy Space Center's Swamp Works laboratory, scientists and engineers are developing robotic concepts for building structures on the moon or Mars focusing on in-situ resource utilization, or living off the land. This robotic arm could be the basis of a system to construct basic shelters for future explorers.*

component of NASA's Orbital Replacement Unit (ORU) Project. ORUs are modular units with quick disconnects that make them easy to replace in their entirety.

Experiments and supplies launched to the space station are processed by the Exploration Research and Technology teams at Kennedy. On Dec. 6, 2015, an enhanced Orbital ATK Cygnus spacecraft was launched atop a United Launch Alliance Atlas V rocket on a commercial resupply services mission to the space station. Cygnus delivered more than 7,000 pounds of equipment and scientific research materials that improve life on Earth and drive progress toward future space exploration.

During the coming year, plans call for additional launches of Cygnus and SpaceX Dragon resupply missions to the ISS.

Biological investigations included a new technology that can detect and identify microorganisms in a variety of sample types. The resulting developments could go from use on the ground to use in microgravity on the space station, and perhaps, beyond low-Earth orbit.

Research scientists are using a portable instrument from BioFire Defense, called RAZOR EX. Originally developed for use by soldiers on the battlefield, first responders also have used it to test biological samples. This technology could meet future exploration mission requirements, including crew health and planetary protection.

Another innovation in work is known as "Swarmies." These small robots are not noteworthy for their hardware, but rather for the coding each carries in its silicon brain that make them search the same way ants do. Each of the robots has its



own camera and a set of hazard-avoidance sensors.

NASA's Office of Education is sponsoring a "Swarmathon" Challenge with minority universities to push the state of the art in collective robotics to autonomously search for, retrieve and map resources, based on the Kennedy-developed technology.

When future explorers journey to Mars, plans call for living off the land. Because it's an autonomous system, a swarm like this could be useful in quickly detecting resources.

Kennedy's Swamp Works is a laboratory where scientists and engineers pursue rapid, innovative and cost-effective exploration mission solutions through partnerships across NASA, industry and academia. Concepts start small and build up fast, with lean development processes and a hands-on approach.

One example of this collaboration with academia included researchers from the University of North Dakota coming to Florida to try out prototype spacesuits in the regolith simulant bin at Swamp Works. The bin is an enclosed area filled with soil that is similar to that found on worlds other than Earth. It carries the same fine, talcum powder texture that was found on the moon and holds up well in comparison to materials known to be on Mars.

In another example of collaboration, engineers from Swamp Works are partnering with the Pacific International





*Dr. Christina Khodadad, a microbiologist with Sierra Lobo on the Engineering Services Contract, prepares a sample pouch for testing July 8, 2015, in the RAZOR EX microbial monitor inside the Molecular Biology Lab in the Neil Armstrong Operations and Checkout Building at Kennedy Space Center. RAZOR is a microbial monitor that amplifies, measures and detects the presence of targeted microorganisms.*

formed out of Hawaiian basalt to demonstrate future concepts for landing on bodies other than Earth.

Kennedy scientists also are developing technologies for in-situ resource utilization including surface excavation, dust mitigation, recourse prospecting of volatiles and metals. The project includes three-dimensional additive construction using surface materials for habitats and launch and landing pads.

Figuring out how to reach Mars requires innovative scientific research. That is one reason why NASA Headquarters Office of the Chief Scientist invests in the Science Innovation Fund. The SIF capitalizes on innovative,

Space Center for Exploration Systems (PISCES) to develop a test site for a lunar landing pad. The development of the site is part of the Additive Construction for Mobile Emplacement (ACME) Project which aims to robotically build a vertical liftoff and landing pad using in-situ resources. Remotely operated from Swamp Works, robots laid specifically designed blocks



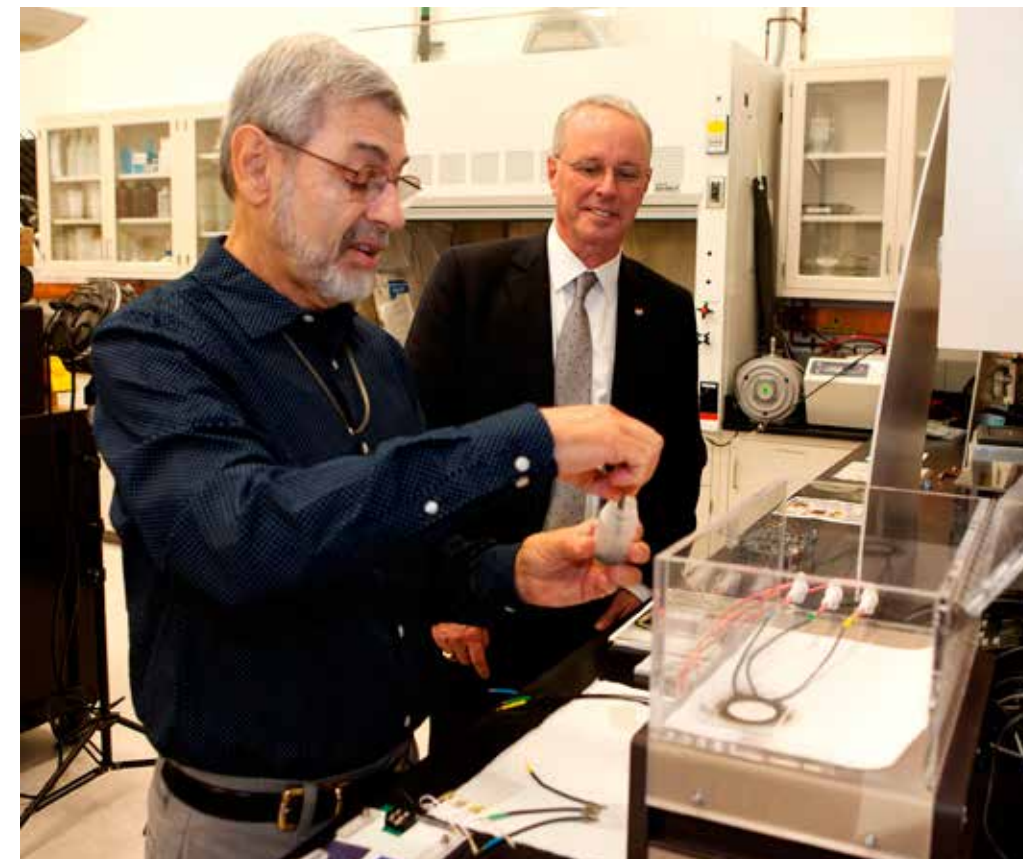
*Inside the high bay in the Space Station Processing Facility at Kennedy Space Center on Oct. 19, 2015, technicians help guide a container of supplies for loading into the Orbital ATK Cygnus pressurized cargo module. The Cygnus module is undergoing prelaunch processing before launch atop a United Launch Alliance Atlas V rocket on a commercial resupply mission to the International Space Station.*

exploratory, high-risk/high-return research undertakings. Of 116 proposals received from across the agency, for the first time, three proposals submitted by Kennedy scientists and engineers were selected.

Chemical Engineer Annie Meier's proposal could benefit human exploration of Mars by increasing carbon dioxide conversion to produce fuel. This type of investment into in situ resource utilization will be required for longer human spaceflight missions.

Dr. Paul Hintze's proposal also makes use of in situ

from other planetary bodies is a primary focus of the Resource Prospector's science payload named RESOLVE, for Regolith and Environment Science and Oxygen and Lunar Volatile Extraction. During the past year, engineers supporting the lunar-destined Resource Prospector mission participated in a field deployment. The RESOLVE payload was hosted by a NASA-developed rover and operated from Kennedy. The RESOLVE payload, whose development is led by Kennedy, includes there spectrometers, a meter-deep drill and an oven which will be used collectively to prospect for water in lunar



*During a visit to Kennedy Space Center on Jan. 6, 2015, NASA Chief Technologist David Miller, right, tours laboratories inside the Swamp Works facility. At left, Dr. Carlos Calle, lead in the Electrostatics and Surface Physics Laboratory, demonstrates a system that uses an electric field wave to move simulated moon dust away from surfaces.*

regolith at the moon's poles.

Many of the technologies being worked in Swamp Works have uses both in space and here on Earth. One of those involves visible light communication, or VLC. Similar to Wi-Fi, it is a wireless system using light-emitting diodes, referred to as Li-Fi.

resources. He is studying a novel instrument that can enable extraction and characterization of organic materials on other planets. This project may help scientists analyze Martian soil samples for a variety of components including amino acids, providing information about potential life forms.

Dr. Mike Hogue's proposal is "Dynamic Gas Flow Effects on the Electrostatic Discharge of Aerospace Vehicle Surfaces." His research would aid mitigating electrostatic charges that build-up due to dust and ice crystals when aerospace vehicles traveling through the atmosphere.

Furthering the understanding of how to harvest resources

Using standard room lighting, VLC transmits data using LEDs to send wireless communications signals. It can be used as a standalone technology or as a supplement to radio-frequency or cellular networks. Ultimately, the innovation has potential applications for use in everything from a local coffee shop to a spacecraft on its way to Mars.

Engineers at Kennedy are designing, developing and testing a propellant transfer system for in-space satellite servicing. These missions would be to inspect, repair and service operational satellites to extend their functional lifespan. Technologies developed in this effort could be applied to the





NASA astronauts Scott Kelly and Kjell Lindgren sample leafy greens harvested June 10, 2015, for the VEG-01 investigation on the International Space Station.

asteroid retrieval mission and other deep-space missions.

Other scientists in the center's Corrosion Technology Laboratory are working on dual purpose technologies such as an environmentally friendly smart coating that could be used in the future to detect and stop corrosion in metal.

Called "Smart Coating for Corrosion Detection and Protection," this innovative technology was recognized by NASA Tech Briefs magazine's "Create the Future Design" contest with the top award in the automotive and transportation category.

One of the most cross-cutting technologies being developed at Kennedy was unveiled on Dec. 9, 2015. Agency officials showcased an innovative system that could allow an engineer or technician working on a space system to immediately access all the information needed to complete a task. Called IDEAS, for the Integrated Display and Environmental Awareness System, it is a wearable, optical computer that allows users to view and modify information on an interactive display.

The glasses become a wearable computer system much like a heads-up display. It can provide various means of communication and access to documentation. This technology is another advancement in the evolution of

computing. What use to take up an entire building, can now fit into a pair of glasses.

During the past year, NASA scientists and engineers have continued to conduct groundbreaking research, enabling future space exploration while improving life here on Earth. The results are fostering technological advancements and new products in medicine, transportation, public safety, environmental quality, agriculture, nanotechnology and manufacturing.

New ideas and creativity continue to be central to a 21st-century launch complex supporting a variety of users as the agency lays the groundwork for the journey to Mars.

Held Oct. 15-17, 2015, the spaceport's annual Innovation Expo provided an opportunity to show off advanced technologies. Employee proposals took center stage as NASA and contractors shared their projects and ideas.

Now in its fourth year, the event has grown to a three-day showcase. This year's Innovation Expo theme, "From Earth to Mars," featured exhibits and presentations from astronauts, a planetary physicist and innovation experts. Subjects included innovations in technology, aeronautics, the International Space Station, and plans to explore Mars, the solar system and beyond. ✨



Load Test #1 on the Interim Cryogenic Propulsive Stage Umbilical (ICPSU) arm for NASA's Space Launch System (SLS) began July 23, 2015, at Coastal Steel in Cocoa, Florida. The test consisted of applying six vertical loads and eight horizontal loads onto the truss in the retracted position to simulate the effects of a launch on the structure. The ICPSU is one of the umbilical arms that will be attached to the mobile launcher. The umbilical will be located at the about the 240-foot-level of the mobile launcher and will supply fuel, oxidizer, pneumatics, hazardous gas leak detection, electrical commodities and environmental control systems to the interim cryogenic propulsive stage of the SLS rocket during launch.



# Engineering

Kennedy Space Center Engineering made significant contributions to the center during 2015 by providing innovative, effective and customer-focused space exploration solutions for a wide variety of programs across the center. Kennedy Engineering is a key partner and service provider in support of Kennedy's transformation as the world's premier multi-user spaceport.

As part of the centerwide reorganization, Kennedy Engineering consolidated new engineering roles and strengthened its technical integration capabilities by adding operations and facilities engineering expertise, and in the creation of a new Construction of Facilities Integration Office and a new Technical Performance and Integration Division.

Work began in FY 2015 on a central campus consolidation with a new headquarters building as one of the major components. The overarching central campus concept will consolidate 11 buildings. It will include a separate facility to operate as a Kennedy Data Center.

Kennedy Engineering also evolved to larger discipline divisions for electrical engineering, mechanical engineering, and for laboratories and test facilities to better manage the development of the technical workforce.

As with the rest of Kennedy, these organizational changes were seamless and were implemented without impacting the commitments and deliverables to the various customers across the center.

Kennedy's engineering expertise and technical capability enabled the Ground Systems Development and Operations (GSDO) Program to meet several key accomplishments and milestones. Ground systems that will support future Orion and Space Launch System (SLS) integration, launch and recovery operations are being designed, tested, installed, and activated in locations

across Launch Complex 39 and the Industrial Area.

FY 2015 accomplishments of note include the arrival of new work platforms in the Vehicle Assembly Building; the delivery of new core stage, upper stage and Orion Service Module Umbilical (OSMU) arms and the start of functional testing of the OSMU arm at the Launch Equipment Test Facility; the start of the pad 39B flame trench modifications; the successful completion of the Spaceport Command and Control System 3.0 software delivery; and support to the GSDO, SLS and Orion critical design reviews.

In support of the Launch Services Program (LSP), the engineering team maintained technical insight and provided



*Morgan Johnson, team lead, ARC CubeSat, from the University of Alaska in Fairbanks, prepares to speak at Vandenberg Air Force Base, California, during a CubeSat overview briefing Oct. 7, 2015. A total of 13 NASA and National Reconnaissance Office-sponsored CubeSats launched aboard a United Launch Alliance Atlas V rocket Oct. 8, from Vandenberg.*

*The Orion Service Module Umbilical (OSMU) underwent a simulated launch test of its umbilical lines connected to Vehicle Motion Simulator 1 at the Launch Equipment Test Facility at Kennedy Space Center. The mobile launcher tower will be equipped with a number of lines, called umbilicals that will connect to the Space Launch System rocket and Orion spacecraft for Exploration Mission 1. Kennedy's Engineering Directorate provided support to the Ground Systems Development and Operations Program for testing of the OSMU.*



mission assurance to LSP's

commercial launch providers, including SpaceX (Falcon 9), Orbital Sciences Corp. (Antares, Minotaur and Pegasus XL), and United Launch Alliance (Delta II, Delta IV and Atlas V). As part of the LSP team, the engineering team supported various certification efforts as well as commercial launches from Cape Canaveral Air Force Station and Vandenberg Air Force Base, including the Soil Moisture Active Passive (SMAP) and Magnetospheric Multiscale (MMS) missions. In addition, the team supported the ELaNax CubeSat Launch on the SMAP mission. The CubeSat Launch Initiative enables the launch of CubeSat projects designed, built and operated by students, teachers and faculty to obtain hands-on flight hardware development experience.

As the Commercial Crew Program continues to make progress toward restoring U.S. capabilities of launching astronauts to the International Space Station (ISS), Kennedy Engineering continues working with our commercial partners. Boeing continues the buildup of the Structural Test Article and modifications to Launch Complex 41 in their facility at Cape Canaveral Air Force Station and modifications to Launch Pad 39A at Kennedy.

Kennedy Engineering supported milestones for component- and system-level preliminary and critical design reviews for commercial partners Boeing and SpaceX. The engineering team provided valuable design, test and operational inputs to commercial partners to ensure these vehicles are safe and reliable systems.

Kennedy Engineering also supported the ISS Program. The team provided technical support for ISS utilization, and engineering support for several experiments, including the

Vegetable Production System (VEGGIE) and Plant Habitat. VEGGIE, designed and developed by Orbital Technologies Corp. with the specific science objectives developed at Kennedy, was successfully delivered to the space station by SpaceX as part of the ISS commercial resupply activities. VEGGIE currently is being utilized to investigate growing different produce and flora in zero gravity. Kennedy Engineering also provided mission console and investigation support for VEGGIE. The Plant Habitat is being designed and developed utilizing Orbital Technologies and Kennedy Engineering resources.

Kennedy Engineering remains engaged in technology development and innovation and continues to support many projects to help enable routine access to space, affordably explore other worlds, and create new approaches to problem-solving. As members of the project teams, the technical expertise, laboratory support and integration services provided by Kennedy Engineering have helped the success of many important R&T activities, including the RESTOR, Resource Prospector/RESOLVE, Ka-Band Objects: Observation and Monitoring (KaBOOM), Additive Construction with Mobile Emplacement (ACME) and Automated Propellant Loading projects.

Kennedy Engineering continues to look for ways to improve its organizational efficiency, effectiveness and technical capability, and is actively collaborating with programs and directorates across the center to help Kennedy be better prepared and postured for the challenges ahead. "Engineering the Future. Today." ✨



# Spaceport Integration

Kennedy Space Center's Spaceport Integration and Services Directorate (SI) serves as the center's backbone, providing the infrastructure and institutional services necessary to a growing, multi-user spaceport. The directorate manages the implementation of commercial tenant agreements, coordinates Kennedy processing activities and center services for all spaceport customers, and maintains a master schedule for integrating commercial and government entities into center operations. The directorate supports each of NASA's key programs based at Kennedy, as well as commercial tenants and other partners across the center, and is leading the center's efforts to establish requirements, policies and procedures for Federal Aviation Administration-licensed commercial launches from Kennedy.

SI manages agencywide procurement of liquid propellants, gases and specialized fluids for NASA, and provided these commodities and related services in support of all FY 2015 launches conducted at Kennedy and Cape Canaveral Air Force Station. The directorate was instrumental to the success of NASA planetary missions, International Space Station resupply missions, and NASA and commercial satellite missions, as well as the Dec. 4, 2014, launch of the agency's Orion spacecraft aboard a United Launch Alliance Delta IV Heavy rocket on Exploration Flight Test-1. Additionally, SI provided hands-on fueling and other support to the testing campaign for Johnson Space Center's Project Morpheus lander, which demonstrated its automated hazard-avoidance system utilizing a hazard field built at Kennedy's Shuttle Landing Facility.



SI continued efforts in FY 2015 to modernize and consolidate the Kennedy Space Center infrastructure to maximize efficiency and cost-effectiveness, freeing up resources for the agency's exploration goals. Officials broke ground Oct. 7, 2014, on the anchor for the spaceport's Central Campus: a seven-story, 200,000-square-foot headquarters building known as Central Campus Phase 1. Construction began in December 2014. SI also completed construction of the new Kennedy Data Center, an energy-efficient, stand-alone facility that will consolidate servers from the Central Instrumentation Facility (CIF) and all of Kennedy's other existing data centers for an 80 percent reduction in "compute space." As a result of the center's 2015 reorganization, these projects will be finalized by the Engineering Directorate.

Once the new facilities are activated, the original, 440,000-square-foot Headquarters Building and the 136,000-square-foot CIF will be demolished. Other projects reduced the center's footprint by an additional 100,000 square feet in FY 2015.

◀ A tower crane stands completed above the construction site of the Central Campus building at Kennedy Space Center on Sept. 17, 2015, as the structural construction phase begins for the seven-story building. The new structure will be more energy efficient than the current Headquarters building and will feature the latest in office and administrative building technology to fulfill Kennedy's role as the premiere spaceport for NASA and, increasingly, commercial entities.

*Inset: As NASA's Kennedy Space Center transitions to a multi-user, 21st century spaceport, the new headquarters building will be the cornerstone of the central campus consolidation. This artist rendering depicts the ultra-modern seven-story, 200,000-square-foot facility that will house about 500 NASA civil service and contractor employees.*



◀ Rappelling down ropes on the side of a building is an inherently hazardous activity. Focusing on safety and reducing risk, Kennedy's Emergency Response Team members use the latest technology including waist harnesses, helmets, gloves and double ropes.



During a training exercise June 16, 2015, an expert in avoiding detection was dispatched to the wooded area near Kennedy's KARS Park II. As the helicopter hovered over a clearing near the woods, armed Emergency Response Team officers used ropes to reach the ground and quickly move into the wooded terrain and track down the intruder.

SI also successfully completed the transformation of multiple contracts to significantly reduce overall expenses and provide more cost-predictable institutional services for Kennedy customers. These included a fixed-price conversion of the existing Institutional Services Contract for facility-related work, a new fixed-price Kennedy Propellants and Life Support Services contract, a fixed-price Flight Operations and Maintenance Support Services contract, and a new cost-plus award fee Kennedy Environmental and Medical Contract.

The directorate supported the ongoing transformation of the Launch Complex 39 area, led by the Ground Systems Development and Operations Program, as critical facilities such as the Vehicle Assembly Building and Launch Pad 39B are prepared to process and launch NASA's Space Launch System (SLS) heavy-lift rocket. Additionally, construction on the new Launch Pad 39C, designed for aerospace companies



seeking to launch small satellites, was completed in July 2015.

Environmental stewardship and sustainability are essential to managing resources and protecting the unique landscape the spaceport calls home. The center scored all “green” on its annual Sustainability Scorecard, meaning all goals were met or surpassed in the reduction of greenhouse gas emissions, energy and potable water usage, use of renewable energy and alternative fuels, green buildings, pollution prevention and waste management, sustainable acquisition and climate change resilience.

Upholding a centerwide culture of sustainability means educating and engaging with the workforce. Spaceport Integration sponsored recycling events encouraging employees to bring in used clothing, bicycles and electronics. The directorate also partnered with the Kennedy Space Center Visitor Complex for a two-day Earth Day celebration featuring former shuttle astronaut Story Musgrave as keynote speaker and demonstrations by more than 50 exhibitors.

Maintaining the safety and security of Kennedy’s skilled team and unparalleled facilities also is one of the directorate’s critical roles. The center’s Aircraft Operations, Fire Rescue, Protective Services and Emergency Response teams join forces throughout the year to conduct intensive training exercises, employing the latest technologies and techniques to protect the spaceport.

Spaceport Integration and Services’ expertise, innovation and efficiency provide the resources and cost-reduction needed to maximize mission success at Kennedy Space Center. ✨

*Tony Anania, chief of the Data Center Services Branch in Kennedy Space Center’s IT and Communications Services Directorate, speaks to employees Oct. 8, 2015, during a tour of the newly opened Kennedy Data Center. At only 16,000 square feet, the data center replaced approximately 45,000 square feet previously dedicated to five “legacy” data centers and IT support areas.*



◀ Kennedy Space Center uses a variety of fuel-efficient vehicles for transportation on the center.

➤ Kennedy Space Center shares boundaries with the Merritt Island National Wildlife Refuge in Florida. The refuge is home to more than 330 native and migratory bird species, along with 25 mammal, 117 fish, and 65 amphibian and reptile species.





# Education

The Kennedy Space Center's Education Project and Youth Engagement Office reached students and teachers throughout Florida and around the nation with a variety of informative scholastic programs, events and outreach activities during Fiscal Year 2015.

Kennedy's Education Office provides numerous hands-on workshops and career panels in STEM – science, technology, engineering and mathematics – to introduce as many young people as possible to the adventure of exploration and the wonders of space. The objective is to attract and retain students in STEM education disciplines through opportunities for both students and faculty.

During the year, Kennedy hosted 814 student activities reaching 34,281 students from kindergarten to 12th grade and 56 events for 3,909 educators. Using electronic media, the Education Office supported 383 Digital Learning Network events for more than 15,490 students and teachers.

Additionally, 1,845 sites connected via IP, or Internet Protocol, webcasts, and there were 62 events for the general public reaching over 16,500 attendees.

Kennedy hosted 93 education interns. They represented 28 states and Puerto Rico, and 61 institutions, including 26 Minority Serving Institutions (MSIs). Of the 93 Education interns, 45 attended MSIs.

Kennedy's Education Office manages two agencywide programs: the Experiment to Stimulate Competitive Research, or EPSCoR, and the Minority University Research and Education Programs, or MUREP, STEM Engagement.

Under EPSCoR, NASA awarded student groups in Oklahoma and Puerto Rico two opportunities to fly experiments aboard the International Space Station. Additionally, EPSCoR supported the National Science Foundation's annual meeting in New Hampshire and the National EPSCoR/Institutional Development Award

Foundation's national meeting in Washington D.C.

In the MUREP Pre-Service Teachers' Professional Development program, teachers were selected to come to Kennedy to learn how to teach STEM content with a space science educational focus, then apply it at a summer camp for students in grades three to six. This experience gave the teachers an opportunity to collaborate with seasoned educators while engaging in an authentic classroom setting. The program included practice in classroom management skills, instructional methodology and the opportunity to expand teacher content knowledge.

On April 30 and May 1, Kennedy specialists

*Astronaut Memorial Foundation education specialist Jen Hudgins holds a balloon partially filled with liquid air. The contents of the balloon condensed after she placed it in cryogenic, or super-cold, liquid nitrogen. Hudgins' demonstration was part of a presentation on March 31, 2015, to students from Sebastian River High School on NASA's work at the Kennedy Space Center.*



*A Southwestern Indian Polytechnic Institute team tests their code during NASA's Swarmathon Challenge in July 2015. Swarmies are robots designed to demonstrate whether it's possible for autonomous machines to scurry about an alien world, such as the moon, searching for and gathering resources.*

at Kennedy's Swamp Works, student teams will operate robots in concert to autonomously search for and map resources. The space center's Swamp Works is based on the concept of a small engineering laboratory built to resolve problems quickly.

As NASA's News Horizons spacecraft arrived at Pluto on July 14, Kennedy's Youth Engagement Office hosted "Plutopalooza" in collaboration with Brevard County 4-H Clubs and the University of Florida's Institute of Food and Agricultural Sciences. Kennedy experts provided NASA-

themed, STEM-inspired workshops focused on the New Horizons mission.

Kennedy also supported the First Nations Launch Competition, a national rocket contest hosted by NASA and the Wisconsin Space Grant with 49 student-designed rockets built and launched. It was open to student teams from either a

travelled to both Murray and Diamond Elementary Schools at Fort Stewart, Georgia. More than 200 students in kindergarten through sixth grade were treated to energetic programs in robotics and the solar system. Kennedy education specialists also met with 117 teachers and nine administrators to provide NASA STEM instructions and resources to aid in reaching groups that are historically underrepresented in these fields.

NASA's sixth Annual Robotic Mining Competition was held in May, with 46 teams from 29 states and over 700 students and faculty advisors attending the week-long event. The teams built a robotic miner to participate in the competition, and wrote a systems engineering paper and an outreach project report.

The University of New Mexico was awarded MUREP grant funding in July 2015 for a cooperative agreement worth \$600,000 for each of the next three years to manage the agency's "Swarmathon Challenge." This NASA event is an innovative competition involving "swarming robotics." In partnership with a NASA subject-matter expert



*Students from the University of Texas at El Paso examine several debris pieces from the space shuttle Columbia. From the left are Jessica Buckner, Ilse Alcantara and Brenda Arellano. They are among those collaborating with NASA engineers at the Kennedy Space Center during the late summer of 2015 in an effort to use lessons learned from the past to design safer spacecraft for the future.*





Inside the robot pit preparation facility May 18, 2015, at NASA's Kennedy Space Center Visitor Complex in Florida, a college team looks over their custom-made robot in preparation for NASA's Robotic Mining Competition. More than 40 student teams from around the U.S. used their remote-controlled mining robots to dig in a supersized sandbox filled with regolith simulant and participate in other competition requirements. The competition is a NASA Human Exploration and Operations Mission Directorate project designed to engage and retain students in science, technology, engineering and mathematics fields by expanding opportunities for student research and design.

Tribal College or an American Indian Science and Engineering Society chapter.

NASA STARS en Español was an example of the agency's Digital Learning Network and Educator Professional Development Collaborative. The program connects students through an online video chat. The live, interactive webcast promoted awareness of the variety of NASA careers in STEM fields. The regions covered by Kennedy Educational Services includes Florida, Georgia, Puerto Rico and the U.S. Virgin Islands, areas with a high concentration of Spanish-speaking citizens. STEM classes, Spanish classes and Spanish clubs were invited to participate and ask questions exploring opportunities in STEM careers.

The sixth annual NASA Kennedy Community Day (formerly

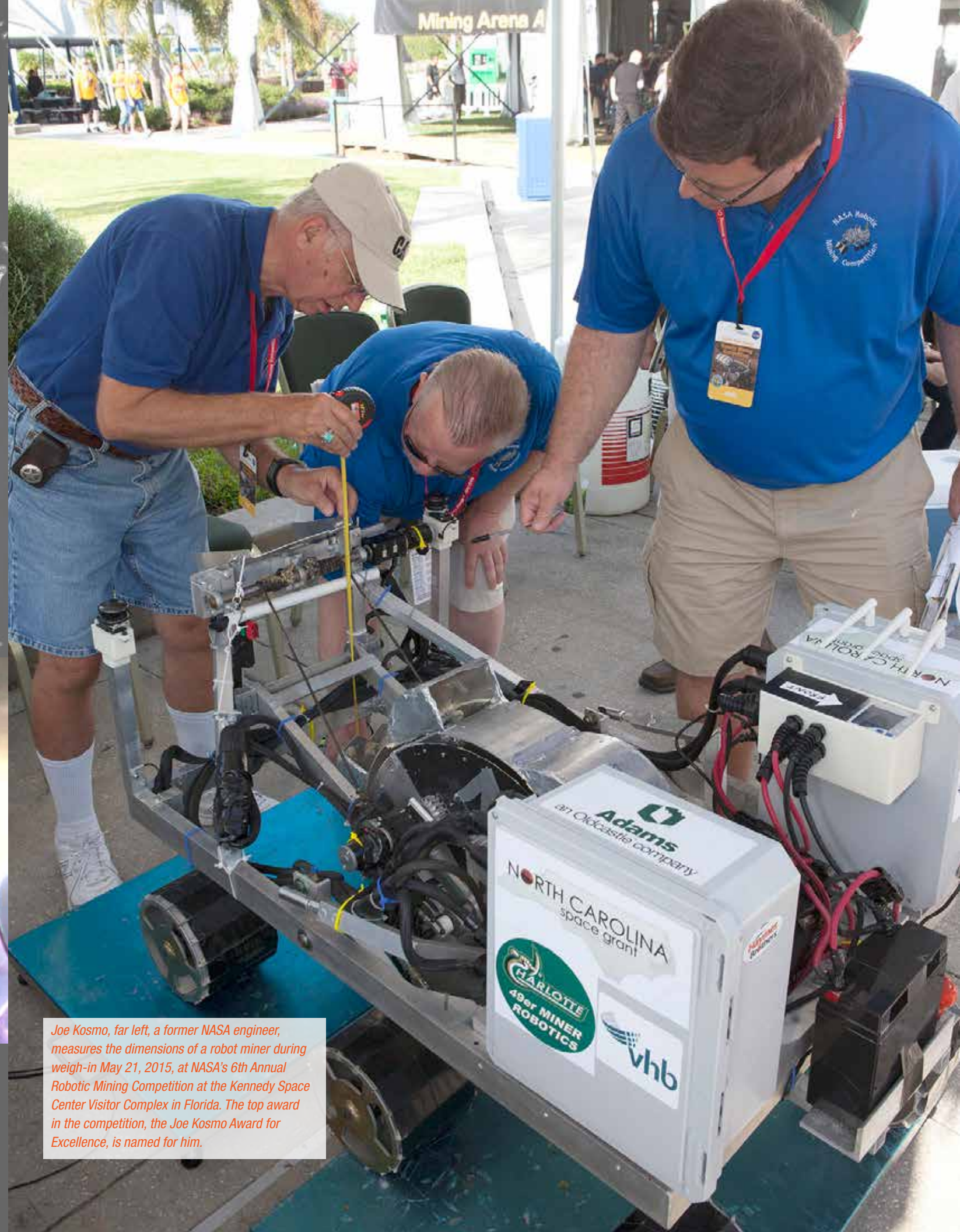
known as NASA Family Education Night) was held Sept. 19, at the space center's visitor complex. Designed for students from kindergarten to 12th grade and their families, more than 6,000 guests participated in presentations by experts from around the Florida spaceport. Appearances included two "Talk with an Astronaut" presentations by center director Bob Cabana, a former space shuttle astronaut.

Kennedy and the Fairchild Tropical Botanic Garden in Miami teamed up for a citizen space challenge called "International Space Station Research: From Earth to Space." NASA scientist Gioia Massa led the challenge that included over 120 middle and high schools from the Miami-Dade and Broward County Public Schools. Participants learned about the types of foods used during America's Mercury, Gemini and Apollo programs. The study then expanded to meals now consumed aboard the space station and the challenges posed by a long journey to Mars.

Each of Kennedy's education programs, designed to encourage young people to consider STEM careers, included the message: Study science, technology, engineering and math carefully and you can one day be one of those helping expand humankind's frontiers of knowledge, capacities and opportunities in space. 🌟



During 2015, South Dakota School of Mines & Technology doctoral student, Eric Schmid, is developing thermal insulating composite materials in the university's labs and at the Kennedy Space Center. The research project on structural thermal insulation composites is part of NASA's Experimental Program to Stimulate Competitive Research, or EPSCoR, program.



Joe Kosmo, far left, a former NASA engineer, measures the dimensions of a robot miner during weigh-in May 21, 2015, at NASA's 6th Annual Robotic Mining Competition at the Kennedy Space Center Visitor Complex in Florida. The top award in the competition, the Joe Kosmo Award for Excellence, is named for him.





# Communication & Public Engagement

Kennedy Space Center's events, launches and transformation to a multi-user spaceport earned attention around the world in Fiscal Year 2015 through the efforts of the professional storytellers and communication specialists who are part of the center's Communication and Public Engagement Directorate's outreach efforts. With six campaigns passed down from the agency's headquarters, Kennedy communicated effectively with the general public on broad themes. From deep-space exploration to low-Earth orbit operations and other factors, the center utilized its expertise in unique ways to enhance public interest and imagination while continuing to drive an efficient and effective organization at the top of its game.

## News Media Operations

Hundreds of professional journalists reported NASA events and milestones as they occurred at Kennedy Space Center during FY 2015 including launches, facility transitions and the acceleration of development for the next generation of human-rated spacecraft. Seven missions began during the year for NASA and with the assistance of the Communication Office. SpaceX launched the first of three cargo resupply missions during the year. Research off the Earth for the Earth depends on supplies and equipment being taken to the orbiting laboratory, and the Dragon spacecraft used for CRS-5

was loaded with thousands of pounds of gear so the station crew could complete that mission. Helping news media around the world understand that vital task was central to the Communication team's efforts to show everyone around the world the work taking place in orbit to answer questions about long-duration missions and to help find solutions to issues on the planet as well. A second SpaceX cargo mission was covered in 2015, CRS-6, giving the team a further opportunity to show NASA's contributions to research for the benefit of all of humanity. The third cargo mission of 2015 showed the team's talents in a different light when the CRS-7 mission encountered a contingency. Despite the unexpected occurrence during ascent, Kennedy's television and web operations performed their role of informing the public about the event without adding alarm. The Communication team executed its own contingency plan to allow the media to cover



At Kennedy Space Center in Florida, NASA leaders spoke to social media participants Dec. 2, 2014, as the Orion spacecraft and its Delta IV Heavy rocket were being prepared for launch. Speakers included NASA Administrator Charlie Bolden, left, and Kennedy Director Bob Cabana.



During a news conference April 14, 2015, at Kennedy Space Center in Florida, agency and contractor officials discussed the launch of the sixth SpaceX commercial resupply services mission to the International Space Station.

the event real-time and get them into position to continue to cover the mission as they saw fit.

The Communication team doesn't only work in Florida. Often, members of the specialized group travel across the country to Vandenberg Air Force Base in California to detail a launch and mission while the rest of the team performs its tasks from Florida to provide the audience with seamless, high-quality coverage. This practice was used in 2015 for the launch of NASA's Soil Moisture Active Passive (SMAP) spacecraft, an Earth-observing satellite that would take detailed soil surveys from orbit to track impacts of climate change and other conditions on ground conditions. Once again, the team proved distance is little challenge for the successful coverage of a NASA mission.

Two products Kennedy produces regularly, the monthly Spaceport Magazine and the weekly video Inside KSC!, continued to garner strong support from readers and viewers in 2015. During FY 2015, average monthly readership of Spaceport Magazine was 7,867. Average weekly viewership of Inside KSC! was about 5,000 views. Both productions require strong team coordination and expertise, and the Kennedy Communication team has consistently met that challenge in ways that benefit the audiences inside and outside the center.

## Kennedy Web Operations

The Kennedy Space Center web page continued to grow in audience size and content throughout 2015, reaching an average of 50,000 views each month. The web presence

was boosted by the center's social media presence on Facebook, Twitter and Instagram, where they reached millions of people across the world with each post. The center's Facebook account exceeded one million likes during the year and continues to grow daily, indicating a rising interest in the groundbreaking missions and work at Kennedy. Web specialists executed NASA's Launch Blog for each mission, including the three cargo resupply missions, SMAP and the Deep Space Climate Observatory (DSCOVR), a mission led by the National Oceanographic and Atmospheric Administration (NOAA) that required significant NASA cooperation.

The coverage included in-depth features and video presentations before each mission that invited web audiences to engage on multiple levels with the processing and launch teams in understanding the science and goals of these flights. Kennedy's Communication team writers contributed more than 250 features and assisted in the production of about 100 videos during FY 2015.

## Guest Operations

Kennedy's Guest Operations staff enabled about 8,100 guests of NASA and its center partners to safely participate in behind-the-scenes Kennedy tours, including education briefings provided by center engineers and operations experts during FY 2015. Guest Operations continued to inspire and engage the public by hosting 15,487 guests to view exciting Launch Services Program launches and Commercial Resupply Services launches to the International Space Station. The





*A permanent memorial, “Forever Remembered,” was unveiled June 27, 2016, in the Space Shuttle Atlantis exhibit at the Kennedy Space Center Visitor Complex in Florida. NASA and astronaut families collaborated on the memorial designed to honor the crews lost on missions STS-51L and STS-107, pay tribute to shuttle vehicles Challenger and Columbia, and emphasize the importance of learning from the past. Encompassing nearly 2,000 square feet, the memorial contains the largest collection of memorabilia and personal items of both flight crews. It also includes recovered hardware from both Challenger and Columbia, never before displayed for the public.*

launches were viewed by members of Congress, business and agency leaders, teachers and students.

## Government Relations

Kennedy Center Director Bob Cabana joined industry representatives at the state capital in Tallahassee to visit with state legislators during Florida Space Day in March. Cabana spoke to local, state and federal elected officials and staff during his annual community briefing. Elected officials from federal, state and local levels toured Kennedy facilities to learn more about the wide range of activities happening at the center during FY 2015, including the three programs headquartered at the center.

## Center Exhibits Program

The Center Exhibits Program continued to support events across Florida in 2015 and played a strong role in supporting agencywide participation in events across the nation. Using products geared to the general public as well as engaging experts, the Center Exhibits Program supported 83 exhibits in 2015, carrying Kennedy’s message to many audiences that may not necessarily encounter NASA and its

professionals. Kennedy’s role in NASA’s overall mission, plus its transformation into a multi-user spaceport and its leading position for commercial spaceflight, were major subjects for the presentations. The team also highlighted the push toward future deep-space exploration that NASA is pursuing and how Kennedy is modifying its processing and launch facilities for the Space Launch System rocket and Orion spacecraft now in development.

## Speakers Bureau

Kennedy’s engineers, technicians and other experts reached more than 76,461 children and adults in 2015. They attended more than 365 events throughout Florida, Georgia and as far away as Norway, sharing their expertise and unique perspectives through career days, science fairs, and community and professional events.

## Kennedy Space Center Visitor Complex

The Kennedy Space Center Visitor Complex, which is operated by Delaware North under contract with Kennedy, drew about 1.6 million visitors in FY 2015, a 10 percent increase over the previous year and a continued reflection of the complex’s



*Martin Wilson, manager of the Thermal Protection System Facility for Jacobs Technology, holds a blowtorch against a heat shield component to show how well the tile dissipates extreme heat. The demonstration was conducted June 26, 2015, for news media and social media participants at the Thermal Protection System Facility at Kennedy Space Center in Florida.*



*A young boy investigates the Ground Systems Development and Operations Program display during the four-day Otronicon event held in January 2015 at the Orlando Science Center in Orlando, Florida.*

quality and dynamic environment. During the year, the visitor complex opened noteworthy exhibits that engaged visitors in meaningful ways and welcomed new artifacts that are helping tell the story of NASA’s future in space exploration.

The “Forever Remembered” exhibit, commemorating the crews of space shuttles Challenger and Columbia, opened in June and has moved visitors who have passed through its halls. The exhibit, which was completed with the close cooperation of the families of the astronauts, showcases personal mementoes of the crews as well as recovered segments of the two shuttles.

The companies playing a large role in NASA’s human spaceflight future were featured more prominently during the year as they turned over new artifacts that tell the story of the agency’s plans to conduct research in orbit aboard the International Space Station, fly astronauts into orbit from American soil and eventually to send crews on explorations into deep space and on a journey to Mars. A SpaceX Dragon capsule used to deliver cargo to the space station went on display at the visitor complex.

The capsule also pointed to the future of American spaceflight because it is the basis of one of the two spacecraft under development to carry astronauts to the station from the Florida spaceport. The other spacecraft also in development is Boeing’s Starliner. Boeing loaned the visitor complex the first pressure vessel built in the Starliner program, and its display in the IMAX theater has helped broaden the impact and clarify the goals of the next generation of human-rated spacecraft NASA and its crews will fly. The Orion spacecraft display, showcasing the spacecraft NASA is developing for deep-space missions by astronauts, was upgraded during 2015 and continues to draw large groups of visitors.

Construction began on the Heroes and Legends attraction, which will house historical collections from the Astronaut Hall of Fame and scores of artifacts from America’s first steps in space exploration. The complex continued to offer visitors opportunities to view launches from destinations around the spaceport such as causeways with direct views of the rockets leaving their launch pads. ✨





# Kennedy Business Report

## Budget Highlights

The Kennedy Space Center Fiscal Year 2015 budget was nearly \$2 billion. The center also performed \$258.1 million in reimbursable work with other government and commercial entities.

During FY 2015, the Commercial Crew Program (CCP) partners, Boeing and SpaceX, made significant progress on the design, development, test, and evaluation (DDTE) of their Crew Transportation Systems with the completion of several significant milestones, including the major accomplishment of the Certification Baseline Review. The CCP continues to make significant progress through an innovative insight/oversight model that enables the commercial partners to progress through the DDTE phase of the program to reach the ultimate goal of a human-rated certification. In addition to the significant progress made in DDTE, the program executed the first Post Certification Mission task order with Boeing, for a planned launch date of December 2017. These activities are all major steps toward transporting our astronauts to the International Space Station aboard a U.S. vehicle.

In FY 2015, the Launch Services Program (LSP) executed a \$558 million budget, both direct and reimbursable. LSP supported two successful mission launches: Magnetospheric Multiscale (MMS) from Cape Canaveral Air Force Station in Florida, and Soil Moisture Active Passive (SMAP) from Vandenberg Air Force Base in California. The program also procured launch vehicle services and other support for several manifested missions scheduled to launch in FY 2016 and beyond.

The Ground Systems Development and Operations Program budget of \$318 million included both Exploration Ground Systems and the 21st Century Space Launch

Complex. In support of the modernization and compatibility efforts for the Exploration Mission 1 launch of the Space Launch System rocket and the Orion spacecraft, key accomplishments included structural modifications to the base and tower of the mobile launcher (ML), ML ground support equipment installation and flame trench construction contract awards, and continued progress on the Vehicle Assembly Building modifications, Launch Complex 39B preparations, and upgrades to the crawler-transporter. In addition, enhancements for the 21st Century Space Launch Complex continue for the development of ground operations infrastructure to facilitate the activities of future customers and stakeholders, including government agencies, commercial industry, and current and future NASA programs.

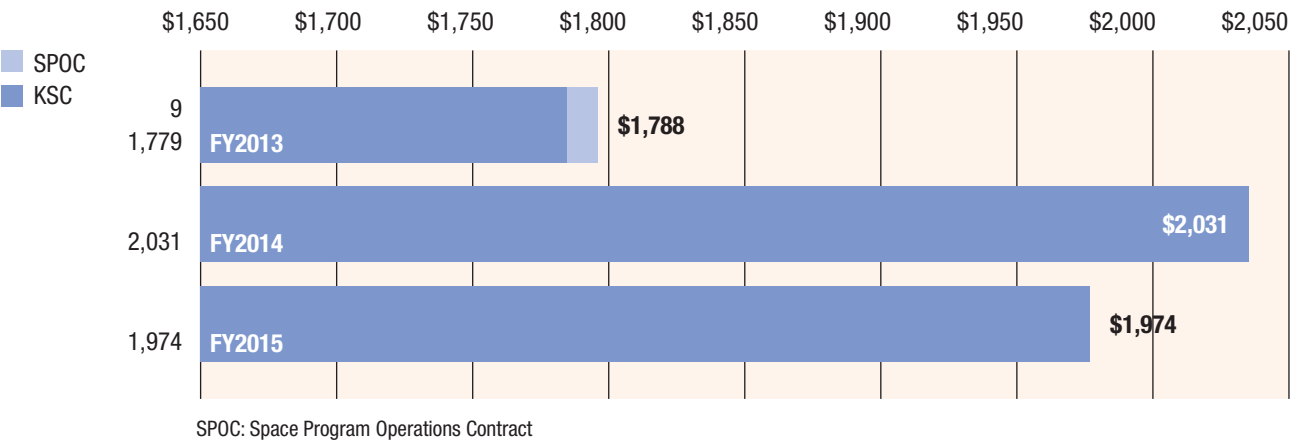
The International Space Station (ISS) Program provided \$62 million in budget to Kennedy, which allowed for continued success toward achieving and maintaining the space station program mission of fully utilizing a permanent human outpost in space. Kennedy mission efforts afforded provisions for ground processing support for experiment hardware, as well as orbital replacement units needed to maintain the space station. In addition, the budget provided for ongoing development of hardware intended to promote full utilization of the space station through the establishment of fundamental biological research capabilities.

Kennedy’s Center Management and Operations (CMO) budget provided \$339 million in FY 2015 to maintain the center’s essential infrastructure, its core technical capabilities, and sustain necessary safety and engineering technical authorities to support NASA’s mission and enable multi-user spaceport readiness.

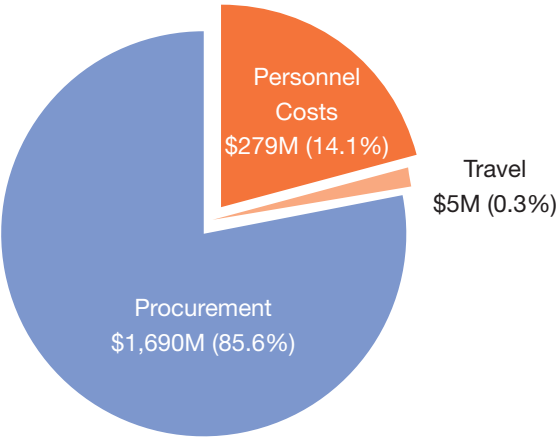
## Kennedy Space Center FY 2015 Budget Authority (\$ in Millions)

Commercial Crew Program	\$769
Launch Services/Science	\$338
Ground Systems Development and Operations	\$318
Space Station	\$62
Center Management & Operations	\$339
Other	\$149
Total KSC	\$1,975

## NASA/KSC Budget Authority Summary FY 2013 through FY 2015 (\$ in Millions)



## FY 2015 KSC Budget by Elements (\$ in Millions) Total \$1.974M





# Workforce Overview

Kennedy Space Center is the most broadly based, complex and successful spaceport in the world. Both NASA and contract personnel working at the center are essential to the success of Kennedy.

The workforce includes people with many skills who are dedicated to supporting the nation’s space program and NASA’s future explorations to destinations including Mars. To accomplish the agency’s various missions, these individuals fulfill a multitude of tasks.

At the end of each year, the center takes a snapshot of its workforce. This picture includes all federal and

contractor employees chartered to work for Kennedy. Other organizations, such as the European Space Agency and Patrick Air Force Base, have roles here but are not reflected in these numbers.

As of Sept. 30, 2015, the total Kennedy population was 7,923. This includes 1,925 NASA civil servants, 73 NASA Pathways interns, 4,088 on-site contractor employees, 133 off-/near-site contractor employees, 1,345 tenants and 359 construction workers. The civil servant skill mix includes those in science, technology, engineering and mathematics positions and those in professional administrative and clerical positions.

Kennedy Space Center Workforce Profile (through 9/30/15)	
Civil Servants	1,925*
NASA Pathways Interns	73
<b>Total Civil Servants</b>	<b>1,998</b>
*includes 1 full-time and 8 part-time permanent employees	
Civil Servants Skill Mix	
Scientific, Technology, Engineering and Mathematics	68%
Clerical and Professional Administrative	32%
On-site Contractor Employees	4,088
Off-site/Near-site Contractor Employees (Excludes construction workers)	133
<b>Total Contractor Employees</b>	<b>4,221</b>
<b>Total Construction Workers</b>	<b>359</b>
<b>Total Tenants</b>	<b>1,345</b>
<b>TOTAL KSC POPULATION</b>	<b>7,923</b>

# Procurement Report

## Industry Partners at a Glance

The companies listed below were some of Kennedy Space Center’s top support or launch services contractors in terms of dollars obligated in FY 2015. Following is a brief description of their work for the agency:

### The Boeing Company

The Boeing Company participated in NASA’s goal toward developing orbital commercial Crew Transportation Systems. Under the Commercial Crew Transportation Capability (CCt-Cap) contract for NASA’s Launch America initiative, The Boeing Company was tasked with developing safe, reliable and cost-effective crew transportation to and from the International Space Station on American spacecraft launched from the United States.

### United Launch Services LLC

United Launch Services, or ULS, a subsidiary of United Launch Alliance, a joint venture between The Boeing Company and Lockheed Martin Commercial Launch Services. ULS provided commercial launch services to NASA using the Delta and Atlas launch vehicles under the NASA Launch Services (NLS) II multiple-award, indefinite delivery, indefinite quantity task order contract. Principal location for the Delta and Atlas vehicle assembly is Decatur, Alabama. Both vehicles launch from Cape Canaveral Air Force Station in Florida and Vandenberg Air Force Base in California.

### Space Exploration Technologies Corp.

Space Exploration Technologies Corp. (SpaceX) participated in NASA’s goal toward developing orbital commercial Crew Transportation Systems. Under the Commercial Crew Transportation Capability (CCtCap) contract for NASA’s Launch America initiative, SpaceX was tasked with developing safe, reliable and cost-effective crew transportation to and from the International Space Station on American spacecraft launched from the United States. SpaceX also participated via a Space Act agreement supporting the agency’s Commercial Crew Integrated Capability (CCiCap) initiative.

## Vencore Services and Solutions Inc.

Vencore provided engineering products and services to Kennedy’s Engineering and Technology Directorate and other center and agency operational customers. Support also included laboratory and developmental shop maintenance and operations, technical services, spaceflight systems engineering and engineering development. Vencore also provided technology outreach to foster awareness and utilization of Kennedy’s unique capabilities.

## Jacobs Technology Inc.

Jacobs Technology Inc., prime contractor for the Test and Operations Support Contract (TOSC), is responsible for the overall management and implementation of ground systems capabilities, flight hardware processing and launch operations at NASA’s Kennedy Space Center. Specific services provided by Jacobs Technology under TOSC include launch vehicle, spacecraft, and payload integration and processing; operations and development of associated processes for ground systems to support integration, processing and launch; servicing and testing of flight hardware; and launch of development and operational flights at Kennedy.

## URS Federal Technical Services Inc.

URS Federal Technical Services provided base operations support for Kennedy. URS Federal Technical Services was responsible for operations, maintenance and engineering for specific Kennedy facilities, systems, equipment and utilities. URS Federal Technical Services also was responsible for calibration and propellants handling at the center.

## Abacus Technology Corp.

Abacus provided communication and information technology services under the Information Management and Communications Support, or IMCS, contract. Abacus supported the majority of these requirements at Kennedy, which included support to agency programs, payloads and launch services. Services provided included hardware and software integration development, computer administration and maintenance, voice and data transmission, library, graphics, publications, printing and reproduction, and IT security.



# Your Procurement Dollars at Work

## Geographical Distribution by State


### (Fiscal Year 2015 Obligations)

STATE	TOTAL DOLLARS	STATE	TOTAL DOLLARS
ALABAMA	9,171,387	NEBRASKA	66,162
ARIZONA	449,397	NEW HAMPSHIRE	76,745
ARKANSAS	36,000	NEW JERSEY	111,333
CALIFORNIA	159,380,808	NEW MEXICO	43,000
COLORADO	380,350,206	NEW YORK	3,477,088
CONNECTICUT	3,955,979	NORTH CAROLINA	331,844
DELAWARE	3,311	OHIO	3,752,042
DISTRICT OF COLUMBIA	166,056	OKLAHOMA	10,597,489
FLORIDA	132,405,401	OREGON	16,180
GEORGIA	7,888,875	PENNSYLVANIA	13,492,899
ILLINOIS	901,731	SOUTH CAROLINA	6,828
INDIANA	2,436,787	SOUTH DAKOTA	38,663
KENTUCKY	18,159	TENNESSEE	79,261,978
LOUISIANA	2,438,942	TEXAS	673,194,527
MARYLAND	187,156,246	VERMONT	3,975
MASSACHUSETTS	682,889	VIRGINIA	240,476,050
MICHIGAN	106,886	WASHINGTON	186,748
MINNESOTA	114,612	TOTAL	\$1,912,849,753
MISSOURI	52,530		

# Top 25 KSC Business Contractors for FY 2015

Contractor	Dollars
THE BOEING COMPANY	657,170,000
UNITED LAUNCH SERVICES LLC	376,642,360
SPACE EXPLORATION TECHNOLOGIES CORP.	184,026,293
VENCORE SERVICES AND SOLUTIONS INC.	127,106,108
URS FEDERAL SERVICES INC.	107,221,412
JACOBS TECHNOLOGY INC.	75,239,045
ABACUS TECHNOLOGY CORP.	52,783,458
J.P. DONOVAN CONSTRUCTION INC.	44,390,200
CHENEGA SECURITY & SUPPORT SOLUTIONS INC.	40,776,585
ORBITAL SCIENCES CORP.	39,887,738
AI SOLUTIONS INC.	37,563,732
INOMEDIC HEALTH APPLICATIONS INC.	17,729,129
FLORIDA POWER AND LIGHT COMPANY INC.	11,294,678
WICHITA TRIBAL ENTERPRISES LLC	10,597,489
A. WEST ENTERPRISE LLC	8,963,207
A-P-T RESEARCH INC.	8,527,054
AIR LIQUIDE LARGE INDUSTRIES U.S. LP	8,094,105
SIERRA NEVADA CORP.	8,000,000
ORBITAL TECHNOLOGIES CORP.	7,699,423
SPEEGLE CONSTRUCTION II LLC	7,655,413
TETRA TECH NUS INC.	7,019,415
BREVARD ACHIEVEMENT CENTER INC.	6,202,691
AIR PRODUCTS AND CHEMICALS INC.	5,867,438
REYNOLDS SMITH AND HILLS INC.	5,109,418
MILLENNIUM ENGINEERING AND INTEGRATION CO.	4,723,440
TOTAL	\$1,860,289,831





National Aeronautics and Space Administration

**John F. Kennedy Space Center**  
Kennedy Space Center, FL 32899  
Public Affairs Directorate

[www.nasa.gov](http://www.nasa.gov)